CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

FOR

BACHELOR OF TECHNOLOGY (B.Tech.)

(4 Year Undergraduate Degree Programme)

IN

COMPUTER SCIENCE AND ENGINEERING

In Data Science and Artificial Intelligence in association with IBM

(In Alignment with National Education Policy, 2020)
[w. e. f. 2024-2025]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
39, Rajiv Gandhi Education City, Sonepat, Haryana-131029

ENGINEERING GRADUATES EMPLOYABILITY ATTRIBUTES

Sound Knowledge and Skills of Basic Sciences & Engineering Sciences	An Engineer should be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
Problem Formulation, Analysis & Solving	An Engineer should be able to identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences, and engineering sciences.
Design and Development of a Solution	An Engineer must be able to design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Investigation	An Engineer should use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
Modern Tools Usage	An Engineer should be able to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
The Engineer and the Society	An Engineer should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.
Environment and Sustainability	An Engineer must understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
Ethics	An Engineer should be able to apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.
Individual and Teamwork	An Engineer should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Effective Communication	An Engineer should be able to communicate effectively on complex Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project Management and Finance	An Engineer must demonstrate knowledge and understanding of the engineering and management principles and apply these to Engineering work environment, as a member and leader in a team, to manage projects and in multidisciplinary environments.
Lifelong Learning	An Engineer must recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

SRM UNIVERISTY DELHI-NCR, SONEPAT

FACULTY OF ENGINEERING AND TECHNOLOGY

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (FEPEOs)

1. Advancement to a professional position by virtue of their knowledge, skills and attitude.
2. Recognition for solving engineering problems and developing design solutions that consider safety and sustainability.
3. Work as successful professionals in diverse engineering disciplines and enterprises;
4. Increasing responsibilities of technical and managerial leadership in their work organizations;
5. Professional development through a commitment to career-long learning.

FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES (FEEPLOs)

1. An ability to identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences
2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability
4. an ability to adapt and work with multidisciplinary teams and communicate effectively;
5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks.
6. An understanding of professional and ethical responsibility;
7. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

MAPPING OF FACCULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES AND FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES	**FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES**
Advancement to a professional position by virtue of their knowledge, skills and attitude.	1. An ability to identify, formulate, and solve real time engineering and socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences 2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
Recognition for solving engineering problems and developing design solutions that consider safety and sustainability	2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice. 3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability
Work as successful professionals in diverse engineering disciplines	3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability 4. an ability to adapt and work with multidisciplinary teams and communicate effectively;
Increasing responsibilities of technical and managerial leadership in their work organizations;	4. an ability to adapt and work with multidisciplinary teams and communicate effectively; 5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks. 6. an understanding of professional and ethical responsibility;
Professional development through a commitment to career-long learning.	6. an understanding of professional and ethical responsibility; 7. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

TABLE 1: MAPPING MATRIX OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES AND FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES (TABULAR FORMAT)

MAPPING	FEPELO1	FEEPLO 2	FEEPLO 3	FEEPLO 4	FEEPLO 5	FEEPLO 6	FEEPLO 7
FEEPEO1	✓	✓					
FEEPEO2		✓	✓				
FEEPEO3			✓	✓			
FEEPEO4				✓	✓	✓	
FEEPEO5						✓	✓

B.TECH - COMPUTER SCIENCE AND ENGINEERING

GRADUATES EMPLOYABILITY ATTRIBUTES

EA 1: Sound Knowledge & Skill of Domain Area: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program

EA 2: Problem solving skills: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

EA 3: Cognitive and Analytical skills: Cognitive& Analytical skills help engineering graduates interpret data, remember team goals. These skills help them recall previous information that may relate to their organization's goals and help them make important connections between old and new information so that they can work more effectively.

EA 4: Design Thinking: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, economic, environmental, cultural and societal considerations.

EA 5: **Transferrable Skills:** Transferable skills are skills and abilities that are relevant and helpful across different areas of life: socially & professionally.

- **Interpersonal skills to work in diverse group:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
- **Communication Skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such abilities include reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
- **Positive attitude and thinking:** An ability to have positive attitude and thinking in challenging situations.
- **Adaptability:** Adapts learning strategies to new conditions. Recognizes parallels, analogies or similarities of new situations to more familiar situations.
- **Learn to Learn:** Learn ⟶ Unlearn ⟶ Relearn: An ability to identify and to address their own educational needs in a changing world, sufficiently to maintain their competence and contribute to the advancement of knowledge.

EA6: Information technology skills: An ability to create, select, adapt, and extend appropriate techniques, resources, and modern ICT tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

EA7: Sustainable Consumption and Production: the demands for system upgrades (domestic and commercial) as well as the move to continuous provision of service (e.g. domestic devices that are always powered and available) needs to be balanced with the views of sustainable consumption and production. Server based solutions – such as Google Docs (Google Docs, 2009) 0– can be considered as one way of addressing such concerns where individuals need not upgrade their own machines as regularly and install local applications (with subsequent updates).

B.TECH - COMPUTER SCIENCE AND ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1. To nurture strong understanding in logical, mathematical and analytical reasoning among students coupled with problem solving attitude that prepares them to productively engage in research and higher learning.

PEO2. To build strong foundation in the field of Computer Science and Engineering among students to be creative and innovative.

PEO3. To prepare students capable of designing and developing real-world computing applications with high societal influence and impact.

PEO4.To provide students with academic environment that enables them to understand the significance of life-long learning in varied situations and teams in global perspective.

PEO5. To inculcate ethical practices, professionalism and environmental awareness for sustainable development among students enabling them for prospective employment in their chosen line of profession globally.

PEO6. To instil communication and management skill that generates entrepreneurship and / or leadership qualities.

B.TECH - COMPUTER SCIENCE AND ENGINEERING

PROGRAMME LEARNING OUTCOMES

PLO1-Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and IC design and technology concepts towards modelling and prototyping Integrated systems.

PLO2-Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PLO3-Design/development of solutions: Design methodology to offer hardware solutions to public health, safety and agriculture, consumer electronics along with cultural, societal, and environmental considerations.

PLO4-Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PLO5-Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PLO6-The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PLO7-Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PLO8-Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PLO9-Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PLO10-Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehended write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO11-Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply the set one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PLO12-Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

TABLE 2: MAPPING MATRIX OF PROGRAM EDUCATIONAL OBJECTIVES (PEO) AND PROGRAM LEARNING OUTCOMES (PLO)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
PEO1	✓	✓										
PEO2			✓	✓								
PEO3					✓	✓						
PEO4							✓	✓				
PEO5									✓			
PEO6										✓	✓	✓

B.TECH COMPUTER SCIENCE AND ENGINEERING

PROGRAMME STRUCTURE

The Computer Science and Engineering curriculum is geared towards providing the student with a strong foundation in the discipline and the tools and competence to address new and challenging problems that they have not seen before. In order to earn a B. Tech. degree in Computer Science and Engineering, a student should secure a minimum of 180 credits in the course of their study. The credit requirements for their program of study are comprised of the following Programme Structure:

- **Basic Applied Sciences (BAS) and Engineering Science (ES):**

The purpose of Basic Applied Sciences in Engineering study is to lay a strong foundation of basic principles of various disciplines such as Mathematics, Physics and Chemistry in the mind of the learners so that they proceed to rest of their years of study with up to date knowledge and training of basic engineering skills. The Engineering Sciences requirements support multiple objectives: first, the courses provide a strong foundation in the basic tools and methodologies common to all engineering disciplines; second, all students are exposed to the basics of each discipline allowing for cross-disciplinary competencies; last, there is a multi-disciplinary project component where students from different engineering disciplines come together on a design project, allowing for practice in collaborative teamwork.

- **Professional Core Courses (PC):** The Professional core courses are aimed at providing the student with a solid foundation in their chosen field of study as per Industry 4.0 skills and knowledge.
- **Practicals (P):**

  The labs are fully furnished and well equipped with latest software's to conduct practicals as per the requirement of the University Curriculum.

- **Professional Electives (PE)-Programme-Specific Specialization Electives:**

  The Professional electives, on the other hand, provide the student with an option to gain exposure to different specializations within the discipline, or an opportunity to study one of the subfields in some depth.

- **Ability Enhancement Courses (AEC)**

  Students are required to achieve competency in a Modern Indian Language (MIL) along with English language with special emphasis on language and communication skills. The courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and academic writing skills. The focus is on imparting students with necessary skills to articulate their arguments and present their thoughts clearly and coherently and recognize the importance of language as a mediator of knowledge and identity.

- **Value Added Courses (VAC):**

Course components relating to skills, attitudes, and values required to take appropriate actions for mitigating the effects of environmental degradation, climate change, and pollution, effective waste management, conservation of biological diversity, management of biological resources, forest and wildlife conservation, and sustainable development and living health and wellness seek to promote an optimal state of physical, emotional, intellectual, social, spiritual, and environmental well-being of a person, the constitutional obligations with special emphasis on constitutional values and fundamental rights and duties

- **Skill Enhancement Courses (SEC)-Technical & Soft Skills:**

  - **Technical Skills:** Under Technical Skills Broad categories of training to be imparted to Engineering Graduates of various disciplines with common nomenclature .The training is categorized into three categories :Elementary, Intermediate & Advanced keeping in view of interdisciplinary approach.(One Credit each from 3rd semester to 6th semester)

  - **Soft Skills:** Under Soft skills training five soft skill courses with defined nomenclature and course content common to all Engineering disciplines are introduced to inculcate Group Dynamics, Teamwork & Leadership Traits by engaging students in interactive sessions through Role Play, Group Discussions, and improve presentation &communication skills of engineering graduates. (One Credit Course from 3rd Semester to 7th semester).

- **Live Projects (LP) and Summer Internship (SI):**

Live Projects is being introduced for all Engineering disciplines from 5th semester - 7th Semester to develop an ability in engineering graduates to apply skills and knowledge attained to solve real life complex problems. (One Credit each semester).

- A student may create live project as an internship project. In that case, the student will be monitored on periodic basis, both by the Industry Expert and the Faculty In-charge. The Industry In-charge will submit the Mid-Term and End-Term Evaluation report. However, the faculty In-charge will take periodic presentation to keep a check on the progress of Student.
- A student may also create live project under the supervision of Institutional faculty (in-house or other institutes of repute). Six step comprehensive approach is introduced for Identification of Projects, Allocation & Monitoring of projects through digital platform.

Summer Internship (SI):

- Students will be monitored on periodic basis, both by the Faculty Mentor from the Industry and the Faculty in-charge from the department. The Faculty Mentor from the Industry will submit the Mid-Term and End-Term Evaluation report. However, the faculty in-charge from the department will monitor and take periodic review to keep a check on the progress of the students.

- Students are provided with the internship-related document which helps them to prepare a report. In addition to this, it provides details to students about internship /project evaluation parameters.

➢ **Multidisciplinary Courses (Humanities & Social Sciences Courses) (MDC)**

The open elective subject courses provide the student with wide latitude to pursue their interests, be it in humanities, management, arts, or their own chosen field of study to have a multidisciplinary approach.

B.TECH COMPUTER SCIENCE AND ENGINEERING
IN
DATA SCIENCE & ARTIFICIAL INTELLIGENCE

TABLE 3: PROGRAMME STRUCTURE

Category of Courses	Category	No. of Courses		
Basic Applied Sciences	BAS			7
Engineering Sciences	ES			10
Professional Core	PC			13
Professional Electives -Program Specific Specialized Elective Courses	PE			12
Ability Enhancement Courses	AEC			4
Skill Enhancement courses (Technical and Soft skills)	SEC	Technical Skills		4
		Soft Skills		5
Value Added Courses	VAC			3
Practical / Workshop	P/W			17
Live Project & Industrial Visit and Summer Internship	LP/SI	Live Project and Industrial Visit	5^{th} -7^{th} Semester	3
		Minor Project	7^{th} Semester	1
		Major Project	8^{th} Semester	1
Multidisciplinary Courses (Humanities & Social Sciences Courses) (MDC)	MDC			3
TOTAL				**82**

BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)

SPECIALIZATION: DATA SCIENCE & ARTIFICIAL INTELLIGENCE DEGREE COURSE

TABLE 4: PROGRAMME CREDIT STRUCTURE SEMESTERWISE

SEMESTER → / COURSES ↓	CATEGORY	I	II	III	IV	V	VI	VII	VIII	TOTAL	%AGE
Basic Applied Sciences	BAS	9	9	4	0	0	0	0	0	22	12.15
Engineering Sciences	ES	9	9	-	0	0	0	0	0	18	9.94
Professional Core	PC	-	-	9	7	5	6	12	0	39	21.55
Professional Electives - Program Specific Specialized Elective Courses	PE	-	-	3	8	10	8	4	0	33	18.23
Ability Enhancement Courses	AEC	5	2	-	0	0	0	0	0	7	3.87
Skill Enhancement courses (Technical and Soft skills)	SEC	-	-	2	2	2	2	1	0	9	4.97
Value Added Courses	VAC	2	2	2	0	0	0	0	0	6	3.31
Practical / Workshop (Major)	P/W	1*	1*	4	3	2	3	3	0	17	9.39
Live Project & Industrial Visit andSummer Internship	LP / SI	-	-	-	0	1	1	6	12	20	11.05
Multidisciplinary Courses (Humanities & Social Sciences Courses) (MDC)	MDC	-	-	-	3	3	3	0	0	9	4.97
TOTAL		**26**	**23**	**24**	**23**	**23**	**23**	**26**	**12**	**180**	**100.0**

Note:* Industry Session for IBM Specialization

COURSE CURRICULUM

TABLE 5: PROGRAMME COURSES CREDIT SRUCTURE SEMESTER WISE

SEMESTER – I

SL. No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
THEORY								
1	24AS101	(BAS)	Engineering Mathematics-I	3	1	0	4	4
2	24AS102/ 24AS103	(BAS)	Engineering Physics/ Engineering Chemistry	3	1	0	4	4
3	24EE101/ 24EC101	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	23ME101/ 23CS101	(ES)	Engineering Mechanics / Fundamentals of Computer & C Programming	3	0	0	3	3
5	24HS101	(AEC)	Communicative English (*50% of students will be offered)	2*	0	0	2*	2*
6	24xx101/ 24FLGR 101-I/ 24FLFR101-I	(AEC)	Hindi-I/German-I/French-I	2	0	0	2	2
7	23ESEB101/ 23VAC102	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
Total Credits (Theory)				**16/18**	**2**	**0**	**18/20**	**18/20**
PRACTICAL								
8	24AS152/24AS153	(BAS)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	2	1
9	23EE151/24EC151	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	23ME151/23 CS151	(ES)	Basic Mechanical Engineering Lab/ C Programming Lab	0	0	2	2	1
11	23ME152/23ME153	(ES)	Mechanical Workshop Lab/Engineering Graphics & Design Lab	0	0	2	2	1
12	24HS151*	(AEC)	Communicative English Lab (50% of students will be offered)	0	0	2*	2*	1*
Total Credits (Practical)				**0**	**0**	**8/ 10**	**8/10**	**4/5**
TOTAL CREDITS (THEORY + PRACTICAL)				**16/18**	**2**	**8/ 10**	**26/30**	**22/25**

** 1 credit practical i.e. 24CAM101- INDUSTRIAL SESSION – I will be offered to IBM Specialization students.
[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

SEMESTER – II

SL. No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
THEORY								
1	24AS201	(BAS)	Engineering Mathematics-II	3	1	0	4	4
2	24AS202/ 24AS203	(BAS)	Engineering Physics/ Engineering Chemistry	3	1	0	4	4
3	24EE201/ 24EC201	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	23ME201/ 23CS201	(ES)	Engineering mechanics / Fundamentals of Computer & C Programming	3	0	0	3	3
5	24HS201	(AEC)	Communicative English (*50% of students will be offered)	2*	0	0	2*	2*
6	24xx201/ 24FLGR 201-II/ 24FLFR201-II	(AEC)	Hindi-II/German-II/French-II	2	0	0	2	2
7	23ESEB201/ 23VAC 202	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
Total Credits (Theory)				**16/18**	**2**	**0**	**18/20**	**18/20**
PRACTICAL								
8	24AS252/24AS253	(BAS)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	2	1
9	23EE251/ 24EC251	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	23ME251/23CS251	(ES)	Basic Mechanical Engineering Lab/ C Programming Language Lab	0	0	2	2	1
11	23ME251/2 3ME252	(ES)	Mechanical Workshop Lab/Engineering Graphics & Design Lab	0	0	2	2	1
12	24HS251*	(AEC)	Communicative English Lab (50% of students will be offered)	0	0	2*	2*	1*
Total Credits (Practical)				**0**	**0**	**8/10**	**8/10**	**4/5**
Total Credits (Theory + Practical)				**16/18**	**2**	**8/10**	**26/30**	**22/25**

** 1 credit practical i.e. 24CAM201- INDUSTRIAL SESSION –II will be offered to IBM Specialization students.

L= Lecture, T = Tutorials, P = Practical's & C = Credits

SEMESTER – III

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
Theory							
23AS301	Engineering Mathematics-III	BAS	3	1	0	4	4
23CAM2009	Python Programming	PC	3	0	0	3	3
24CS2001	Data Structures	PC	3	0	0	3	3
23CS2005	Database Management Systems	PC	3	0	0	3	3
24CSPExxx	Professional Elective-I	PE	3	0	0	3	3
Total (Theory)			**15**	**1**	**0**	**16**	**16**
Practical							
23CAM2115	Python Programming Lab	P	0	0	2	2	1
24CS2113	Data Structures Lab	P	0	0	2	2	1
23CS2111	Database Management Systems Lab	P	0	0	2	2	1
23VAC103	Sports, Yoga & Fitness	VAC	1	0	2	3	2
23CAM2117	Industry Session : Data Science	P	0	0	2	2*	1
Total (Practical)			**1**	**0**	**10**	**11**	**6**
Skill Enhancement Course							
24CS0201C	Digital Marketing	SEC	0	0	2	2	1
23SS351	Effective Communication Skills	SEC	0	0	2	2	1
Total (Skill Enhancement)			**0**	**0**	**4**	**4**	**2**
Total (Theory + Practical+ Skill Enhancement)			**15**	**1**	**14**	**30**	**24**

NOTE: At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-I)

SEMESTER – IV

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
Theory							
24MDC401	Multidisciplinary Elective-I	MDC	3	0	0	3	3
23CAM2004	Cloud Application Development	PC	2	0	0	2	2
23CAF2006	Agile Development Methodology	PC	2	0	0	2	2
23CSPEXXX	Professional Elective-II	PE	3	1	0	4	4
23CS2006	Operating Systems	PC	3	0	0	3	3
23CSPEXXX	Professional Elective-III	PE	3	0	0	3	3
Total (Theory)			**16**	**1**	**0**	**17**	**17**
Practical							
23CAM2120	Cloud Application Development Lab	P	0	0	2	2	1
23CAF2118	Agile Development Lab	P	0	0	2	2	1
23CS2114	Operating Systems Lab	P	0	0	2	2	1
23CSPEXXX	Professional Elective-III Lab	PE	0	0	2	2	1
Total (Practical)			**0**	**0**	**8**	**8**	**4**
Skill Enhancement Course							
24CS0202B	Design Thinking and Augmented Virtual Reality	SEC	0	0	2	2	1
23SS452	Teamwork & Interpersonal Skills	SEC	0	0	2	2	1
Total (Skill Enhancement)			**0**	**0**	**4**	**4**	**2**
Total (Theory + Practical+ Skill Enhancement)			**16**	**1**	**12**	**29**	**23**

NOTE: At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-II)

**** To be evaluated in current semester.**

SEMESTER – V

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
Theory							
24MDC501	Multidisciplinary Elective-II	MDC	3	0	0	3	3
23CAM3001	Machine Learning Using R	PC	3	0	0	3	3
23CAF3005	Essentials of Hadoop	PC	2	0	0	2	2
23CSPEXXX	Professional Elective-IV	PE	3	1	0	4	4
23CSPEXXX	Professional Elective-V	PE	3	1	0	4	4
Total (Theory)			**14**	**2**	**0**	**16**	**16**
Practical							
23CAM3115	Machine Learning Using R Lab	P	0	0	2	2	1
23CAF3113	Hadoop Lab	P	0	0	2	2	1
23CSPEXXX	Professional Elective-V Lab	PE	0	0	2	2	1
23CSPEXXX	Professional Elective-IV Lab	PE	0	0	2	2	1
23CS0303A	Live Project-I & Industrial Training	LP**	0	0	2	2	1
Total (Practical)			**0**	**0**	**10**	**10**	**5**
Skill Enhancement Course							
24CS0301A	Wearable Technology	SEC	0	0	2	2	1
23SS553	Presentation Skills	SEC	0	0	2	2	1
Total (Skill Enhancement)			**0**	**0**	**4**	**4**	**2**
Total (Theory + Practical+ Skill Enhancement)			**14**	**2**	**14**	**30**	**23**

NOTE: At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-II)

**** To be evaluated in current semester.**

BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)

SPECIALIZATION: DATASCIENCE & ARTIFICIAL INTELLIGENCE DEGREE COURSE

PROGRAMME COURSES SRUCTURE SEMESTER WISE

SEMESTER – VI

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
Theory							
23CAM3002	Artificial Intelligence	PC	3	0	0	3	3
24CAF3010	NoSQL and MongoDB	PC	3	0	0	3	3
23CSPEXXX	Professional Elective-VI	PE	3	0	0	3	3
23CSPEXXX	Professional Elective-VII	PE	3	1	0	4	4
24MDCXX	Multidisciplinary Elective-III	MDC	3	0	0	3	3
Total (Theory)			**15**	**1**	**0**	**16**	**16**
Practical							
23CAM3116	Artificial Intelligence Lab	P	0	0	2	2	1
24CAF3012	NoSQL and MongoDB Lab	P	0	0	2	2	1
23CSPEXXX	Professional Elective-VI lab	PE	0	0	2	2	1
23CAM3014	Industry Session : Deep Learning	P	0	0	2	2	1
23CS0304A	Live Project-III & Industrial Visit	LP**	0	0	2	2	1
Total (Practical)			**0**	**0**	**10**	**10**	**5**
Skill Enhancement Course							
24CS0302D	Data Analytics Tools	SEC	0	0	2	2	1
23SS654	Professional Skills	SEC	0	0	2	2	1
Total (Skill Enhancement)			**0**	**0**	**4**	**4**	**2**
Total (Theory + Practical+ Skill Enhancement)			**15**	**1**	**14**	**30**	**23**

NOTE: At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-III)

**** To be evaluated in current semester.**

SEMESTER – VII

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
Theory							
24CAM4003	Quantum Computing	PC	3	1	0	4	4
24CAF4005	Data Science	PC	3	1	0	4	4
24CS4001	Deep Learning	PC	3	1	0	4	4
23CSPEXXX	Professional Elective-VIII	PE	3	1	0	4	4
Total (Theory)			**12**	**4**	**0**	**16**	**16**
Practical							
24CAM4007	Quantum computing Lab	P	0	0	2	2	1
24CAF4009	Data Science Lab	P	0	0	2	2	1
23CAM4011	Industry Session : Block Chain	P	0	0	2	2	1
23CS4115A	Live Project-III & Industrial Training	LP**	0	0	2	2	1
23CS4117A	Minor Project	LP	0	0	10(4)	10(4)*	5
Total (Practical)			**0**	**0**	**12**	**12**	**9**
Skill Enhancement Course							
23SS756	Interpersonal Skills : Strategies	SEC	0	0	2	2	1
Total (Skill Enhancement)			**0**	**0**	**2**	**2**	**1**
Total (Theory + Practical+ Skill Enhancement)			**12**	**4**	**14**	**30**	**26**

*** Teaching Load**

**** To be evaluated in current semester.**

BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)

SPECIALIZATION: DATASCIENCE & ARTIFICIAL INTELLIGENCE DEGREE COURSE

PROGRAMME COURSES SRUCTURE SEMESTER WISE

SEMESTER – VIII

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
Practical							
23CS4114	Major Project*	LP/ SI	0	0	24	24	12
Total (Theory + Practical+ Skill Enhancement)			**0**	**0**	**24**	**24**	**12**

* *To be monitored at the Institute Level*

** *Teaching Load*

LIST OF ABILITY ENHANCEMENT COURSES

Total: 6 (3*2) Credits						
University Pool Common to all UG Programs						
Course Code	**Course**	**Category**	**L**	**T**	**P**	**Credits**
24HS101/24HS201 24HS151/24HS251	Communicative English Communicative English Lab	AEC	2	0	2	3
24 HIN101-I/24FLGR-I/24FLFR-I	Hindi/ German/French (Phase-I)	AEC	2	0	0	2
24 HIN101-II/24FLGR-II/24FLFR-II	Hindi/ German/French (Phase-II)	AEC	2	0	0	2

LIST OF SKILL ENHANCEMENT COURSES

Course Code	Course	Category	L	T	P	Credits
TECHNICAL TRAINING						
24CS0201A/ 24CS0201B/ 24CS0201C/ 24CS0201D	Data Structure and Algorithmsusing C or C++/ Industry Automation Level-I/ Digital Marketing/ Fundamentals of CAD for Engineers	SEC	0	0	2	1
24CS0202A/ 24CS0202B/ 24CS0202C	Introduction to SPSS Tool/ Design Thinking and Augmented Virtual Reality/ Programming Using Python for Engineers	SEC	0	0	2	1
24CS0301A/ 24CS0301B/ 24CS0301C/ 24CS0301D/ 24CS0301E	Wearable Technology /Big Data Analytics, Tools andTechniques/ Machine Learning using Python/ Industry Automation Level-II/ RCC Structure Drawing Training	SEC	0	0	2	1
24CS0302A/ 24CS0302B/ 24CS0302C/ 24CS0302D	Artificial Intelligence andMachine Learning/ MATLAB for Engineers/ Structural Analysis using FEM-based Tools/ Data Analytics Tools	SEC	0	0	2	1
SOFT SKILL						
23SS351	Effective Communication Skills	SEC	0	0	2	1
23SS452	Teamwork & Interpersonal Skills	SEC	0	0	2	1
23SS553	Presentation Skills	SEC	0	0	2	1
23SS654	Professional Skills	SEC	0	0	2	1
23AR755	Aptitude and Reasoning	SEC	0	0	2	1

LIST OF VALUE ADDED COURSES

Total: 6 (2*3) Credits						
Course Code	**Course**	**Category**	**L**	**T**	**P**	**C**
23ESEB101/ 23ESEB201	Environment Bioengineering	VAC	2	0	0	2
23VAC101/ 23VAC201	Environment Protection and Sustainable Development	VAC	2	0	0	2
23VAC102/23VAC202	Indian Constitution and Polity	VAC	2	0	0	2
23VAC103	Sports, Yoga and Fitness	VAC	1	0	2	2
Note:						
All Courses are compulsory for the students.						
Students would be encouraged to opt NCC/NSS.						

LIST OF MULTIDISCIPLINARY COURSES (HUMANITIES & SOCIAL SCIENCES COURSES) (HSS)

Total: 9 (3*3) Credits						
Code	**Category**	**Course**	**L**	**T**	**P**	**C**
23MDC101/ 24MDC101A/ 24MDC101B/ 24MDC101C/ 24MDC101D	(MDC-I)	Statistical Methods/ Computer-Based Numerical and Statistical Technique/ Probability and Random Process/ Biostatistics/ Numerical Methods	3	0	0	3
23MDC102		Environmental Geosciences & Disaster Management	3	0	0	3
23MDC301		IPR in Business	3	0	0	3
23MDC302		Library Information Sciences & Media Literacy	3	0	0	3
23MDC401		Management Process & Organizational Behaviour	3	0	0	3
23MDC103	(MDC-II)	Photonics	3	0	0	3
23MDC104		Chemistry & Society	3	0	0	3
23MDC303		Psychology and Emotional Intelligence	3	0	0	3
23MDC304		Indian Economy	3	0	0	3
23MDC402		Creating an Entrepreneurial Mind	3	0	0	3
24MDC 106A/ 24MDC 106B		Numerical Methods in BME/ Discrete Mathematics	3	0	0	3
23MDC105	(MDC-III)	Life Sciences & Public Health	3	0	0	3
23MDC305		Electoral Literacy in India	3	0	0	3
23MDC403		Personal Financial Planning	3	0	0	3
23MDC404		Interior Design	3	0	0	3
24MDC107		Probability & Statistics	3	0	0	3

Note

1. These courses will be of introductory level and shall have 3 credits.
2. Student will not be allowed to choose or repeat the courses already gone through in class XII and present in Program core and specialization.
3. Student will have option to choose any 3 out of the pool.

*Course shall be based on applications, tools and techniques.

LIST OF DEPERTMENTAL ELECTIVE COURSES

1. Specialization-I

Elective	Course Code	Course	Category	L	T	P	C
I	24CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	23CSPE2004	Theory of Computation	PE	3	1	0	4
III	24CSPE2008/ 24CSPE2118	Analysis and Design of Algorithms /Algorithms Lab	PE	3	0	1	4
IV	24CSPE3001/ 24CSPE3117	Compiler Design/CD Lab	PE	3	1	1	5
V	24CSPE3003/ 24CSPE3113	Computer Networks/CN Lab	PE	3	1	1	5
VI	24CSPE3004/ 24CSPE3118	Software Engineering/SE Lab	PE	3	0	1	4
VII	23CSPE3030	Neural Networks & Fuzzy Logic	PE	3	1	0	4
	23CSPE3038	Business Intelligence	PE	3	1	0	4
	23CSPE3032	Cyber Security	PE	3	1	0	4
	23CSPE4037	NASSCOM Associate Analytics – II	PE	3	1	0	4
VIII	23CSPE4025	Data Warehousing & Data Mining	PE	3	1	0	4
	23CSPE4039	NASSCOM Associate Analytics – III	PE	3	1	0	4
	23CSPE4019	Network Security & Cryptography	PE	3	1	0	4

2. Specialization-II

Elective	Course Code	Course	Category	L	T	P	C
I	24CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	23CSPE2004	Theory of Computation	PE	3	1	0	4
III	24CSPE2008/ 24CSPE2118	Analysis and Design of Algorithms /Algorithms Lab	PE	3	0	1	4
IV	24CSPE3001/ 24CSPE3117	Compiler Design/CD Lab	PE	3	1	1	5
V	24CSPE3003/ 24CSPE3113	Computer Networks/CN Lab	PE	3	1	1	5
VI	24CSPE3004/ 24CSPE3118	Software Engineering/SE Lab	PE	3	0	1	4

VII	23CSPE3024	Software Project Management	PE	3	1	0	4
	23CSPE3028	Object Oriented Analysis & Design	PE	3	1	0	4
	23CSPE3034	Design Thinking	PE	3	1	0	4
VIII	23CSPE4033	Software Testing	PE	3	1	0	4
	23CSPE4031	Open Source Software	PE	3	1	0	4

3. Specialization-III

Elective	Course Code	Course	Category	L	T	P	C
I	24CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	23CSPE2004	Theory of Computation	PE	3	1	0	4
III	24CSPE2008/ 24CSPE2118	Analysis and Design of Algorithms /Algorithms Lab	PE	3	0	2	4
IV	24CSPE3001/ 24CSPE3117	Compiler Design/CD Lab	PE	3	1	2	5
V	24CSPE3003/ 24CSPE3113	Computer Networks/CN Lab	PE	3	1	2	5
VI	24CSPE3004/ 24CSPE3118	Software Engineering/SE Lab	PE	3	0	2	4
VII	23CSPE3020	Distributed Operating System	PE	3	1	0	4
	23CSPE3026	Grid Computing	PE	3	1	0	4
	23CSPE3040	Internet of Things	PE	3	1	0	4
VIII	23CSPE4023	Wireless Adhoc and Sensor Network	PE	3	1	0	4
	23CSPE4035	Advanced Java Programming	PE	3	1	0	4
	23CSPE4027	Mobile Computing	PE	3	1	0	4

EVALUATION SCHEMES

The bifurcation of Continuous Evaluation (Internal) and End Semester Evaluation marks are as under:

S.No	Course	Continuous Evaluation (Internal)	End Semester	Remarks
1	Professional (PC) : Theory	40	60	
2	Professional Electives –Programme Specific Electives-Theory	40	60	
3	Open Electives-Theory	40	60	
4	Humanities & Social Sciences including Management Courses (HSS)-Theory	40	60	
5	Practical /Workshop - Practical	60	40	
6	Skill Enhancement Courses (SEC)	70	30	
7	Technical Enhancement Courses (TEC)	70	30	
8	Live Projects & Industry Visits (LP/IV) and Internship	60	40	
9	Dissertation/Project	60	40	

SEMESTER - I & SEMESTER – II

SEMESTER - I & SEMESTER – II

FUNDAMENTALS OF COMPUTER & C PROGRAMMING	
Course Code: 23CS101	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To familiarize and understand the basic concepts of digital computers and computer programming.
- To impart adequate knowledge on the need of programming languages and problem solving techniques.
- To analyse and construct effective algorithms.
- To develop problem solving ability using programming.
- To employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

COURSE LEARNING OUTCOMES (CLO)

After the completion of course, students will be able to:

- Understand the fundamental concepts of computers, both hardware and software.
- Learn and understand the major system software's that help in developing of an application.
- Apply and analyse the basic programming constructs in context of C programming language.
- Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions
- Create and manipulate a database or data storage through files.
- Develop a methodological way of problem solving.
- Learn a programming approach to solve problems.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6	CLO7
CO1	✓	✓					
CO2		✓	✓				
CO3			✓	✓			
CO4					✓		
CO5						✓	✓

CONTENTS

Unit-I: INTRODUCTION OF COMPUTER SYSTEM

Anatomy of a digital Computer, Different Units of Computer, System, Hardware & Software, Classification of Computer Systems, Number systems, Operating System: Definition, working & its functions, Basic concepts of Computer Networks, Network Topologies

Unit-II: INTRODUCTION TO SYSTEM SOFTWARE

Programming language- Definition, types; Syntax & Semantics, Type of programming errors, Assembler, Linker, Loader, Compiler, Interpreter, debuggers, Algorithms, flowcharts and their symbols.

Unit-III: BASICS OF 'C' LANGUAGE

C Fundamentals, Basic data types, variables and scope, operators and expressions, formatted input/ output, expressions, selection statements, loops and their applications.

Unit-IV: ARRAY & FUNCTION

Arrays, functions, recursive functions, pointers and arrays. Strings literals, arrays of strings; applications. Storage Classes and Pre-processor Directives.

Unit-V: STRUCTURE & FILE SYSTEM

Structures, Declaring a Structure, Accessing Structure Elements, Storing Structure elements, Array of Structures, Unions and Enumerations.

File Input/Output, Data Organization, File Operations, Opening a File, Reading from a File, Closing the File, Writing to a File, File Opening Modes.

TEXT BOOKS

- The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
- Computer System & Programming in C by S Kumar & S Jain, Nano Edge Publications, Meerut.
- Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2010, New Delhi.
- Let Us C, Yashwant Kanetkar, 14th Edition, BPB Publications.
- Computer Fundamentals and Programming in C, Reema Theraja, Oxford

REFERENCE BOOKS

- Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH.
- Theory and problem of programming with C, Byron C Gottfried, TMH.

C PROGRAMMING LAB	
Course Code: 23CS151	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To develop problem solving ability using programming.
- To impart adequate knowledge on the need of programming languages and problem solving techniques.
- To develop a methodological way of problem solving
- To learn a programming approach to solve problems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

- Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.
- Introduction to C Programming using Control Statements and Repetition Statement
- Apply and practice logical formulations to solve some simple problems leading to specific applications.
- Design effectively the required programming components that efficiently solve computing problems in real world.
- Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOME (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓	✓		
CO3				✓	
CO4					✓

LIST OF EXPERIMENTS

1. Write a program to find the largest of three numbers. (if-then-else)
2. Write a program to find the largest number out of ten numbers (for-statement)
3. Write a program to find the average mail height & average female heights in the class (input is in form of sex code, height).
4. Write a program to find roots of quadratic equation using functions and switch statements.
5. Write a program using arrays to find the largest and second largest no. out of given 50 nos.
6. Write a program to multiply two matrices.
7. Write a program to sort numbers using the sorting Algorithm.
8. Represent a deck of playing cards using arrays.
9. Write a program to check that the input string is a palindrome or not.
10. Write a program to read a string and write it in reverse order.
11. Write a program to concatenate two strings.
12. Write a program which manipulates structures (write, read, and update records).
13. Write a program which creates a file and writes into it supplied input.
14. Write a program which manipulates structures into files (write, read, and update records).

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

TEXT BOOKS

- The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
- Computer System & Programming in C by S Kumar & S Jain, Nano Edge Publications, Meerut.
- Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2010, New Delhi.

REFERENCE BOOKS

- Let Us C, Yashwant Kanetkar, 14th Edition, BPB Publications.
- Computer Fundamentals and Programming in C, Reema Theraja, Oxford
- Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH.

Engineering Mathematics-I (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:23AS101	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: NIL	

COURSE OBJECTIVES

1. To familiarize the students with techniques in Matrix Algebra, Laplace transforms and complex analysis.
2. To introduce the concept of differentiation, partial differential and its applications.
3. To understand the calculation of double & triple integrals with their applications as area and volume.
4. To get the knowledge thatillustrate the concepts of vector calculus to understand solenoidal and irrotational vectors with inter dependence of line, surface and volume integral.
5. To able to have good knowledge in Fourier series.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors required for matrix diagonalization process
2. Apply the knowledge of differentiation, partial differentiation, Maxima and minima of two variables for analyzing engineering problems.
3. Apply the multiple integrals in engineering applications.
4. Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stroke's theorems.
5. Solve different problems with help of Fourier series.

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

CO \ CLO	01	02	03	04	05
01	✓				
02		✓			
03			✓		
04				✓	
05					✓

COURE CONTENTS

Unit-I Matrices

Introduction of Matrices, Rank of a matrix, Inverse of a square matrix, Linear Dependence & Independence of vectors, Solution of equations type AX = 0 and AX = B, Eigenvalues and Eigenvectors, Cayley Hamilton theorem (without proof), Diagonalisation of Matrices, Applications of matrices.

Unit – II: Differentiation

Successive differentiation, Leibnitz theorem, Taylor's Theorem, Maclaurin's theorem. Partial differentiation of first

& higher order, Total differential coefficient, differentiation of implicit functions, Homogenous function, Euler's theorem on homogenous functions, Taylor's theorem for two variables, Maxima and minima of two variables, Jacobians.

Unit-III: Multiple Integral

Double integrals, change of order of integration, Double integration in polar coordinates, change of variables, Triple integral, applications of multiple integration – area and volume. Gamma and Beta function and their properties.

Unit-IV: Vector Calculus

Differentiation of vectors, Scalar and vector point functions, Gradient, Divergence, Curl, Vector identities, Directional derivatives, Integration of vectors: Line, surface and volume integrals, Green's, Gauss divergence and Stroke's theorems (without proof), simple applications of these theorems.

Unit-V: Vector Spaces

Vectors in two-dimensional space and n-dimensional space, Vectors addition and scalar multiplication of Vectors, Vector Spaces: Definition and Examples General properties of vector spaces, Linear combination of Vectors, Linear independence, and Linear dependence of Vectors. Linear transformations, linear operators, Properties of Linear Transformation, Algebra of Linear transformation, Matrix Representation of linear transformation, Linear map Associated with Linear Transformation.

TEXT BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017
2. Kandasamy P etal. Engineering Mathematics, S.Chand&Co., New Delhi, Redevised edition, 2017
3. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018

REFERENCE BOOKS

1. Kreyszig.E, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons. Singapore, 2015
2. Bali N.P., Goyal M, Watkins C, Advanced Engineering Mathematics: A Complete Approach., Advanced Engineering Mathematics, Laxmi Publications, New, Delhi.2018
3. Jain R. K., Iyengar S. R. K., "Advanced Engineering Mathematics", 6th edition, Narosa Publishing House, 2019.

Engineering Mathematics-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:23AS201	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60Marks
L T P : 3 1 0	
Prerequisite: Engineering Mathematics-I	

COURSE OBJECTIVES

1. To familiarize the students with techniques in differential and integral calculus, differential equation of first and second order, series solution of differential equations, vector calculus.
2. To enable students to have skills that will help them to solve real-world problems based on different types differential equations.
3. To describe Laplace and inverse Laplace transform with their properties.
4. To understand analytic functions and conformal mapping and complex integration.
5. To equip the students with standard concepts and tools that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.
2. Obtain series solution of differential equation and explain application of Bessel's function
3. Apply Laplace transforms to find the solution of differential equations.
4. Know, analytic functions and conformal mapping of complex variables.
5. Evaluate complex integration and residues.

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURE CONTENTS

Unit-I: Linear Differential Equation

Linear differential equation with constant Coefficient , Complimentary Functions, Particular Integrals , Euler – Cauchy differential equations, Second order linear differential equations –One part of CF is known, Reduction to Normal form, Variation of Parameters & Method of undetermined coefficient.

Unit-II: Laplace Transforms

Laplace Transforms, Existence theorem, Standard properties, Laplace transforms of derivatives and integrals, Unit step function, Periodic functions, Inverse Laplace transforms, Convolution theorem, Applications of Laplace transforms for solving IVP and BVP.

Unit-III: Complex Variable - I

Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations (Cartesian and polar), Harmonic functions, Determination of harmonic conjugate, Milne-Thomson's method, and conformal mappings: rotation, reflection, inversion and bilinear transformation.

Unit-IV: Complex Variable - II

Line integral, Cauchy's integral theorem, Cauchy's integral formulae, application of Cauchy's integral formulae, Taylor's and Laurent's expansions (statements only), Singularities, Poles and Residues, Cauchy's residue theorem and applications.

Unit-V: Series Solutions

Power series method, validity of series method, Frobenius method. Bessel's equation, and Bessel's function, generating function, Recurrence relation, Orthogonal properties, Transformation of Bessel's equation., Lagendre's equation, Legendre polynomials, generating function, recurrence relation, Rodrigue's formula, Orthogonal properties of Legendre's polynomials.

TEXT BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017
2. J.W. Brown and R.V. Churchill, Complex Variables and Applications, MC Graw Hill, 9thedition, 2013
3. E. Kreyszig, Advanced Engineering Mathematics, Wiley-India, 10th Edition, 2017

REFERENCE BOOKS

1. Kandasamy P etal. Engineering Mathematics, S.Chand&Co., New Delhi, Redevised S. Ponnusamy, Foundations of Complex Analysis,Narosa Book Distributors, 2011.
2. Dass H. K., Advanced engineering Mathematics, Sultan Chand Publication, Delhi, 2013

ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	
Course Code: 23AS102/202	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To provide students with the knowledge of variety of important concepts of Physics and their applications in Engineering and Technology
- To enhance the understanding of the concepts found in Mechanics, Harmonic Oscillations, wave Optics, Lasers, Fiber Optics.
- To familiarize the quantum mechanical approach and its application in engineering.
- To develop necessary understand on semiconductors and their applications in devices; Apply theory learnt to correlate with the environmental issues such as the use of solar cells

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.
- An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.
- The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.
- The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on semiconductor devices such as solar cell.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES			
	CLO1	CLO2	CLO3	CLO4
CO1	✓		✓	
CO2	✓	✓		
CO3			✓	

CO4				✓

COURSE CONTENTS

Unit-I: OSCILLATIONS & ULTRASONIC WAVES

Oscillations: Simple Harmonic Motion (SHM), Differential Equation of SHM and its Solutions, Conservation of Energy. Mass-string System. Damped Harmonic Oscillator-Over damped, Critically Damped, Under Damped motions, Relaxation Time, Forced vibrations. Resonance & Quality Factor. **Ultrasonic Waves:** Methods of production-Magnetostriction & Piezoelectric, Applications of Ultrasonic.

Unit-II: OPTICS

Interference: Interference due to division of wavefront: Fresnel's Bi-prism, Interference due to division of amplitude: wedge shaped film, Newton's rings. **Diffraction**: Fresnel's Diffraction and Fraunhofer's diffraction, single slit diffraction, transmission diffraction grating, absent spectra. **Laser:** Spontaneous and stimulated emission, Einstein's coefficients, Characteristics of laser, semiconductor laser. **Fiber optics:** Structure of optical fiber, Principle of propagation and numerical aperture, acceptance angle, classification of optical fiber (Single mode and Multimode).

Unit-III: ELECTROMAGNETIC THEORY

Mathematical Background: Gradient, Divergence, curl (Physical Significance), Irrotational & Solenoidal Field, Gauss Divergence and Stoke's Theorem, Important Vector Identities. **Maxwell's Equations**: Modification in Ampere's Circuital Law, Maxwell's Equation in Integral & Differential forms. Wave equation for Electromagnetic (EM) Waves-Propagation in free space, Characteristic Impedance, Poynting Vector (simple numerical), EM Energy Density

Unit-IV: STATISTICAL MECHANICS & QUANTUM MECHANICS:

Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Quantum Mechanics: Black body problem, Photoelectric effect and Compton scattering (For concept), de Broglie Hypothesis of matter waves, Davison Germer experiment, Uncertainty Principle, Application of Uncertainty Principle, Basic Features of Quantum Mechanics: Transition from deterministic to Probabilistic, wave function, probability density, Normalization of wave function, operators, expectation values, Schrodinger equation-Time dependent and time independent equation Application: Particle in a box (1-D).

Unit-V : SEMICONDUCTOR:

Intrinsic & Extrinsic Semiconductors (p and n- type)- Expression for the Density of Electrons in Conduction Band & Holes in Conduction band, Fermi level Dependence on Temperature and Carrier Concentrations. Semiconductor p-n Junction: Energy Band Diagram, p-n Junction with Forward & Reverse bias. I-V Characteristics, Zener & Avalanche breakdown. Tunnel Diode. Hall Effect: Experimental Determination of Hall Coefficient, Mobility of p and n- type Semiconductors. Photovoltaic effect and Solar Cell.

TEXT BOOKS

1. Beiser A, Concepts of Modern Physics, 5th Ed., McGraw Hill International, 2003.
2. AjoyGhatak, Optics, 5th Ed., Tata McGraw Hill, 2012.
3. David J. Griffiths, Introduction to Electrodynamics, Pearson Education Limited, London, 2015.
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
6. Engineering Mechanics (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati , McGraw Hill

REFERENCE BOOKS

1. Arumugam, M., Engineering Physics, 2nd edition, Anuradha Publishers, KumbaKonam, 2003.
2. Gaur and Gupta, Engineering Physics, 7th edition, Dhandapani and Sons, New Delhi, 1997.
3. N. Subrahmanyam and Brij Lal, Waves and Oscillations.
4. David J. Griffiths, , Introduction to Quantum Mechanics, Pearson Education Limited.

ENGINEERING PHYSICS LAB
(COMMON TO ALL BRANCHES)

Course Code: 23AS152/252	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory
- To learn the usage of electrical and optical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Use the different measuring devices and meters to record the data with precision
- Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
- Apply the mathematical concepts/equations to obtain quantitative results

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES		
	CLO1	CLO2	CLO3
CO1	✓	✓	
CO2		✓	
CO3			✓

LIST OF EXPERIMENTS

Experiment 1: To determine the dispersive power of a given prism
Experiment 2: To determine the width of single slit by diffraction
Experiment 3: To determine the wavelength of the given laser source using standard grating
Experiment 4: To determine Planck's Constant (h)
Experiment 5: To determine the attenuation, numerical aperture and acceptance angle of the given optical fiber

Experiment 6: To determine the velocity of ultrasonic waves in liquids
Experiment 7: To determine the wavelength of sodium light by Newton's ring experiment
Experiment 8: To determine the moment of inertia of the disc and rigidity modulus of the wire by torsional pendulum
Experiment 9: To determine the specific rotation of sugar solution by polarimeter.
Experiment 10: Study of Hall Effect.
Experiment 11: Energy gap determination by Four-Probe method
Experiment 12: Determination of unknown resistance using Meter Bridge
Experiment 13: Plotting of characteristic curve of a PN junction diode.
Experiment 14: Verification of laws of vibration of string using sonometer.
Experiment 15: Determination of acceleration due to gravity by Bar pendulum

TEXT BOOKS

1. Chattopadhyay, D., Rakshit, P. C and Saha, B., "An advanced Course in Practical Physics", 2nd edition, Books & Allied Ltd, Calcutta, 1990.
2. Chauhan and Singh, "Advanced practical physics", Revised edition, Pragati Prakashan Meerut, 1985.

REFERENCE BOOKS

- Thiruvadigal. J. D., Ponnusamy S. Vasuhi, P. S. and Kumar. C, "Hand Book of Practical physics", 5th edition, Vibrant Publication, Chennai, 2007.
- Engineering Practical Physics, by S. Panigrahi and B. Mallick, (CENGAG eLearning)

ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	
Course Code: 23AS103/203	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- The knowledge of water quality parameters and the treatment of water.
- To predict the bulk properties and processes using thermodynamic considerations
- To learn various types of fuels and their properties, and to understand the basics of spectroscopy.
- To learn an introductory idea about new materials.
- To understand the fundamental concepts on fuels and corrosion chemistry.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Understand to identify the quality of water and how to improve the quality of water.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Get preliminary understanding on introductory idea about nano materials.
- Analyze the quantitative aspects of fuel combustion, spectroscopy and the mechanism of corrosion.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOME / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO 02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

Unit-I

Water Technology: Reasons for hardness-units of hardness-determination of hardness and alkalinity - Water for steam generation-Boiler troubles -Scale, Sludge formation, Boiler corrosion, Caustic embrittlement-Internal treatments-Softening of Hard water : Lime-Soda process and numerical problems based on these processes and Ion Exchange process -Water for drinking purposes- Purification -Sterilization and disinfection: Chlorination, Break point chlorination and other methods - Reverse Osmosis and Electro Dialysis.

Unit-II

The phase rule: Statement of Gibb's phase rule and explanation of the terms involved, Phase diagram of one component system – water and sulfur system, Condensed phase rule, Phase diagram of two component system – Eutectic Bi-Cd, Pb-Ag system.

Unit-III

Fuels: Classification of fuels, calorific value. G.C.V. and N.C.V., Solid fuels, Analysis of coal. Liquid fuels: Classification of petroleum, Refining of petroleum, Cracking, Knocking and anti-knocking, cetane and octane numbers.

Spectroscopy: Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, effect of conjugation on chromophores.

Unit-IV

Corrosion: Electrochemical theory of corrosion, galvanic series, Types of corrosion; Differential metal corrosion, Differential aeration corrosion (Pitting and water line corrosion), Stress corrosion (caustic embrittlement in boilers), Factors affecting, metal coatings – Galvanizing and Timing, Corrosion inhibitors, cathodic protection.

Unit-V

New Materials: Introduction to nanomaterials, classification (0D, 1D, 2D) with examples, size dependent properties, Top-down and Bottom-up approaches of nanomaterial synthesis. Introductory idea on synthesis of nanomaterials via green synthetic route. Application of nanomaterials in environmental fields and electronic devices.

TEXT BOOKS

1. Engineering Chemistry (NPTEL web-book) by B. L. Tembe, Kamaludddin and M. S. Krishan.
2. Text Book in Applied Chemistry by A. N. Acharya and B. Samantaray, Pearson India.
3. Fundamentals of Molecular Spectroscopy by Banwell, Tata McGraw Hill Education.
4. Textbook of nanoscience and Nanotechnology, McGraw Hill Education (India) Pvt. Ltd., 2012.
5. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publication.
6. Engineering Chemistry by Prasanta Rath, Cenage Learning India Private Ltd., 2015.
7. A text book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai & Co. 2020
8. Inorganic Chemistry by Donald A. Tarr, Gary Miessler, Pearson India, Third Edition.
9. Molecular Spectroscopy, Ira N. Levine, John Wiley and Sons.
10. Modern Spectroscopy – A Molecular Approach, by Donald McQuarrie and John Simon, published by University Science Books.

REFERENCE BOOKS

1. Inorganic Chemistry by W. Overton, Rounk and Armstrong, Oxford Univesity Press, 6th edition.
2. Advanced Engineering Chemistry by M. R. Senapati, University Science Press, India.
3. A Text book of Engineering Chemistry by S.S. Dara, 10th Edition, S. Chand & Company Ltd., New Delhi, 2003

ENGINEERING CHEMISTRY LAB
(COMMON TO ALL BRANCHES)

Course Code: 23AS153/253	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

An integrated laboratory course consists of experiments from applied chemistry and is designed:

- To impart the knowledge and understanding of principles of measurement techniques.
- To understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Understand the basic concepts of measurement techniques.
- The synthesis, dynamics, chemical transformation and their applications

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOME / COURSE OBJECTIVES	CLO 01	CLO 02
CO 01	✓	
CO 02		✓

LIST OF EXPERIMENTS

(A Student is supposed to complete/perform minimum 10 of experiments)

1. Determination of total hardness of water by EDTA method.
2. Determination of dissolved oxygen in a sample of water.
3. Determination of percentage of available chlorine in a sample of bleaching powder.
4. Standardization of KMnO4 using sodium oxalate. Determination of ferrous iron in Mohr's salt by potassium permanganate.
5. Determination of Viscosity of addition polymer by Ostwald Viscometer.
6. Determination of amount of sodium hydroxide and sodium carbonate in a mixture.
7. Estimation of calcium in limestone.
8. Proximate analysis of coal.
9. Determination of cell constant and conductance of solutions.

10. Determination of partition coefficients of iodine between benzene and water.
11. Determination of rate constant of acid catalysed hydrolysis reaction.
12. Acid-Base Titration by Potentiometry.
13. Preparation of colloidal/nano particle solutions

TEXT BOOKS

1. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney, Longman Scientific & Technical, England
2. Applied Chemistry: Theory and Practice (Latest ed.), by O.P. Vermani & A.K. Narula, New Age International Publications.

REFERENCE BOOKS

1. Dara, S.S.; A text book on Experiments and Calculations in Engineering Chemistry (ninthedition); S. Chand, 2003.
2. Rani, S.; Laboratory Manual on Engineering Chemistry; Dhanpat Rai, 1998
3. Department Laboratory Manual

BASIC ELECTRONICS ENGINEERING

(COMMON TO ALL BRANCHES)

Course Code: 23EC101/201	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To impart the knowledge of the passive and active electronic components
- To understand basics characteristics of Field Effect Transistors
- To introduce the CMOS devices
- To gain the knowledge of integrated circuit fabrication techniques
- To introduce the digital logic gates and systems
- To understand the principle of microprocessors

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- To learn the fundamental concepts of semiconductor devices
- An ability to apply the concept of diode in clipper and clamper circuits
- Acquire the skills of constructing the different transistors configurations
- To learn the basic concepts of integrated circuits
- To Compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates
- To acquire the knowledge of microprocessors.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES					
	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓	✓				
CO2		✓	✓			
CO3			✓	✓		
CO4			✓	✓		
CO5					✓	

CO6						✓

COURSE CONTENTS

Unit-I

Introduction to Semiconductors, Junction Diode: Principle of Diodes, V-I characteristics of junction diode, AC and DC Resistance of Diode, Diode Current Equation, Equivalent circuit of Diode, Breakdown Mechanism, Zener Diode, Rectifier circuit, Clipper and Clamper, Avalanche Diode Bipolar Junction Transistor: Transistor Operation, Current Equation in n-p-n & amplifier ; p-n-p transistors, CB,CE,CC Configurations and their Characteristics, Load line Analysis, DC Biasing (Fixed bias and Voltage Divider), Introduction to Amplifiers

Unit-II

Field Effect Transistor: JFET-types, Operations and their Characteristics, MOSFETs- types, Operations and their Characteristics CMOS: Brief Introduction to CMOS, Principle of operation of Digital Inverters, VTC Characteristics

Unit-III

Introduction to integrated Circuits, Fabrication Techniques, The Ideal Op Amp, Inverting and Non – Inverting configurations, Equivalent Circuit model, Op amp application in Integration, Differentiation and Summing Circuits.

Unit-IV

Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic Logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic, Logic Gates, Boolean algebra and Combinational Logic Circuits: Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table. Basic combinational logic circuits, Implementation of combinational logic, the universal properties of NAND and NOR gates, Basic adders

Unit-V

Introduction to microprocessor: Four-bit microprocessor architecture, stored program computer, instruction set and basic assembly language programming and introduction to computer architecture

TEXT BOOKS

1. Electronic Devices and Circuit Theory - by Rober L. Boylestad 11th Edition, Pearson Publication, 2014
2. Digital Design by M. Morris Mano, 5th Edition, Pearson Publication, 2016
3. Floyd T.L., Buchla D.L., "Electronics Fundamentals: Circuits, Devices and Applications", 8th 2010 Edition
4. Stallings, W., "Computer Organization and Architecture", 5th Ed., 2001 Pearson Education

REFERENCE BOOKS

1. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition
2. Muthusubramanian.R, Salivahanan.S, Muraleedharan.K.A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw - Hill, 1999.
3. Microelectronic Circuits by A. S. Sedra and Kenneth C. Smith 7th Edition, Oxford University Press. 2017

BASIC ELECTRONICS ENGINEERING LAB
(COMMON TO ALL BRANCHES)

Course Code:23EC151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To study the different types of electronic components and equipments
- To observe characteristics of electronic devices
- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Measure voltage, frequency and phase of any waveform using CRO.
- Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
- Analyze the characteristics of different electronic devices such as diodes, transistors and operational amplifiers
- To develop skill to build and verify digital circuits

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOME / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓	✓		
CO 02			✓	
CO 03				✓

LIST OF EXPERIMENTS

1. To study the Digital Cathode Ray Oscilloscope (CRO) and operation of multi-meters.
2. To study active and passive electronic components and function generators.
3. Study of the V-I characteristics of P-N junction diode & Calculate DC & AC resistance.
4. Construction of half-wave rectifier (with & without filter) and calculation of efficiency and ripple factor.
5. Construction of full wave rectifier circuits (with & without filter) and calculation of efficiency and ripple factor
6. Construction of positive, negative and biased clamper circuits using CRO

7. Construction of positive, negative and biased clipper circuits using CRO
8. Design of inverting amplifiers using Op-Amp for a given gain with the help of breadboard and distinct components.
9. Design of and non-inverting amplifiers using Op-Amp for a given gain with the help of breadboard and distinct components.
10. Study and realization digital logic gates with truth table verification

TEXT BOOKS

1. "Electronics Lab Manual", K.A. Navas ,Volume 1, Fifth Edition. 2015 by PHI Learning Private Limited, Delhi.

REFERENCE BOOKS

1. Electronic Devices and Circuit Theory - by Rober L. Boylestad 11th Edition, Pearson Publication, 2014
2. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition

BASIC ELECTRICAL ENGINEERING
(COMMON TO ALL BRANCHES)

Course Code: 23EE101/201	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To impart knowledge about the electrical quantities and to understand the impact of electricity in a global and societal context.
- To introduce the fundamental concepts relevant to DC and AC circuits and network theorems.
- Highlight the importance of electromagnetism and transformers in transmission and distribution of electric power.
- To explain the working principle of Measuring Instruments.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Learn about transient analysis of RLC circuits with DC excitation.
- Realize the requirement of transformers in transmission and distribution of electric power and other applications.
- Develop an idea on Magnetic circuits, Electromagnetism
- Learn about measuring instruments, single phase and polyphase AC circuits

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	CLO 1	CLO 2	CLO 3	CLO 4
CO1	✓			
CO2			✓	
CO3		✓	✓	✓
CO4	✓			✓

COURSE CONTENTS

UNIT-I

D.C. Network Laws and Theorems: Definition of active, passive, linear, non-linear circuit elements and networks, Ohm's Law, Kirchhoff's Laws, Nodal and Loop methods of analysis, Star to Delta & Delta to Star transformation. Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transfer theorem, Millman's theorem.

UNIT-II

Single Phase A.C. Circuits: a) Sinusoidal signal, instantaneous and peak values, RMS and average values, crest and peak factor, Concept of phase, representation-polar & rectangular, exponential and trigonometric forms, response of R, L and C components in A.C. circuits. Series and Parallel A.C. circuits. Concept of active and reactive power, power factor, series and parallel resonance, Q factor, cut-off frequencies and bandwidth.

UNIT-III

Magnetic field, Concept of magnetic circuits, Magnetomotive Force, Reluctance, Ampere's circuital law and Biot-Savart law, Determination of B/H curve, Comparison of electric and magnetic circuit, Electromagnetic induction, Faraday's laws of electromagnetic induction, Direction and Magnitude of induced E.M.F. Self and mutual Inductance, Inductances in series and parallel, Energy stored in inductor, Capacitance, Capacitance in series and parallel, Relationship between charge, voltage and current, Energy stored in capacitor.
Transformers: Construction, EMF equation, ideal transformer, Phasor diagram on no load and full load, equivalent circuit, losses, regulation and efficiency, open and short circuit test

UNIT-IV

Polyphase system, Advantages of 3-phase system, Generation of 3-phase voltages, Voltage, current and power in a star and delta connected systems, 3-phase balanced and unbalanced circuits, Power measurement in 3-phase circuits.

UNIT-V

Measuring Instruments: Introduction to galvanometer (Moving coil and moving iron), ammeter, voltmeter, wattmeter, energy meter, use of shunt and multiplier.
Cathode Ray Oscilloscope: Theory of storage oscilloscope.

TEXT BOOKS

1. Fundamental of Electric Circuits by Charles K Alexander and Matthew N. O. Sadiku, TMH Publication.
2. Electrical Engineering Fundamentals by Vincent Del Toro, PHI Publication.
3. Basic Electrical Engineering by V N Mittal & Arvind Mittal, TMH Publication.
4. Basic Electrical Technology by A.E. Fitzgerald, McGraw Hill Publication.

REFERENCE BOOKS

1. Kothari D P and Nagrath I J, "Basic Electrical Engineering ", Tata McGraw Hill,1991
2. Electrical & Electronic Technology by Hughes, Pearson Education India

BASIC ELECTRICAL ENGINEERING LAB
(COMMON TO ALL BRANCHES)

Course Code: 23EE151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

- To impart basic knowledge of electrical quantities such as current, voltage, power, energy etc.
- To familiarize students with basic circuit components and their connections.
- To explain working principle of transformer and electrical measuring instruments such as ammeter, voltmeter, wattmeter, energy meter, digital storage oscilloscope etc.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Verify fundamental laws like Ohm's Law, KCL, KVL, etc.
- Understand the calibration of energy meter.
- Understand open circuit and short circuit test of single-phase transformer.
- Analyse RLC series and parallel circuits

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	CLO 1	CLO 2	CLO 3	CLO 4
CO1	✓	✓		✓
CO2	✓			✓
CO3	✓	✓	✓	✓

LIST OF EXPERIMENTS

(A Student is supposed to complete/perform minimum **10** experiments)

- To verify Kirchhoff's voltage and Current Laws
- To verify Superposition Theorem
- To verify Thevenin's Theorem
- To verify Maximum Power Transfer Theorem
- To verify Norton's Theorem
- To measure power and power factor in single phase AC circuit.
- To verify Series and parallel RLC circuit
- To conduct open circuit and short circuit test on a single-phase transformer
- To perform Load test on single phase transformer
- Calibration of Single Phase & Three Phase Energy Meter

- To study Digital Storage Oscilloscope
- To study the balanced three phase system for star and delta connected load
- To study about earthing and their types.

TEXT BOOKS

1. Handbook of Laboratory Experiments in Electronics and Electrical Engineering by A M Zungeru, J M Chuma, H U Ezea
2. Electrical Measurements & Measuring Instruments by E.W. Golding & F.C. Widdis
3. Electronic Measurement & Instrumentation by H.S. Kalsi
4. Electrical & Electronic Measurement & Instrumentation by A.K. Sawhney ,E. Fitzgerald, C. Kingsley and S. Umans, Electric Machinery, McGraw-Hill Co. Inc.
5. D. P. Kothari and I. J. Nagrath, Electrical Machines, Tata McGraw-Hill.

REFERENCE BOOKS

1. M.G. Say, Alternating Current Machines, Pitman Publishing.
2. Alexander S. Langsdorf, Theory of Alternating Current Machinery, Tata McGraw-Hill.

ENGINEERING MECHANICS (Common to all Branches)	
Course Code: 23ME101/201	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To familiarize students with basic concepts and terms associated with thermodynamics.
- To impart students with the application of thermodynamics in real engineering application.
- To familiarize students with the working principle and application of power transmission systems.
- To make students aware of terms associated with robots and automation.
- To acquaint students with basic measuring tools and instruments used in mechanical engineering.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Understand the concepts of thermodynamics.
- Apply principles of thermodynamics to real engineering problems.
- Understand the basics of powertrain applications.
- Grasp the elements of robotics.
- Understand the working principles of various measuring tools and devices.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES				
	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT-I-Thermodynamics:

Systems, Properties, Process, State, Cycle, Internal energy, Enthalpy, Zeroth Law, First law and Second Law of Thermodynamics, Basic Concept of Entropy, Properties of ideal gas., Properties of pure substances, Steam formation, Types of Steam, Enthalpy, Specific volume,Internal energy and dryness fraction of steam, use of Steam tables. Related numericals.

UNIT –II - Application of Thermodynamics:

Air compressors, Steam Power Plant, Refrigerators and Heat pump, I.C. Engines (Brief Description of different components of above mentioned systems and working principles withSchematic diagram only)

UNIT –III- Basic Power transmission devices:
Belt, Rope, Gear drives. Coupling, clutch, brakes. (Working principle only)

UNIT –IV- Mechanical Measurements:
Temperature, pressure, velocity, flow, strain, force, torque measurements. (Working principle only).

UNIT- V - Introduction to Robotics:
Robot anatomy, joints and links and common robot configurations

TEXT BOOKS

1. Basic Mechanical Engineering by Pravin Kumar, Pearson
2. Basic Mechanical Engineering by A R Israni, P K Shah, BS Publications
3. Text book of Elements of Mechanical Engineering, S T Murthy, Universities press
4. Basic and applied Thermodynamics by P. K. Nag, Tata McGraw Hill

REFERENCE BOOKS

1. Basic Mechanical Engineering by .D. Mishra, P.K Parida, S.S.Sahoo, India Tech Publishing company
2. Elements of Mechanical Engineering by J K Kittur and G D Gokak, Willey
3. .Basic Mechanical Engineering by Basant Agrawal, C M Agrawal, Willey
4. Engineering Thermodynamics by P. Chattopadhaya, Oxford University Press

BASIC MECHANICAL ENGINEERING LAB (Common to all Branches)	
Course Code: 23ME151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To acquaint students with the working of thermal power plants.
- To make students understand the working of 2 and 4 stroke IC engines.
- To familiarize students with the working of Refrigeration and Air Conditioning cycles.
- To acquaint students with different automobile parts, gears and gear trains.
- To familiarize students with flow meters and U-tube manometers.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- The working of thermal power plants.
- The working of 2 and 4 stroke IC engines.
- Different automobile parts, gears and gear trains.
- The working of Refrigeration and Air Conditioning cycles.
- The working principles of flow meters and U-tube manometers.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES				
	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3				✓	
CO4			✓		
CO5					✓

LIST OF EXPERIMENTS

(A Student is supposed to complete/perform minimum of 5 experiments)

1. Model study of Steam Power Plant
2. Model study of Two stroke and Four stroke I.C. Engine
3. Model study of Refrigerator & Air conditioners
4. Model study of Automobile Parts
5. Determination of velocity ratio of belt drive
6. Study of Gears and Gear trains
7. Verification of Bernoulli's Theorem and its application to Venturi meter.
8. Calibration of Bourdon Tube Pressure gauge and measurement of pressure using manometers.

TEXT BOOKS

1. Laboratory Manual

REFERENCE BOOKS

1. Power Plant Engineering, P.K Nag, Tata McGraw Hill, ISBN- 0070435993.
2. Ramalingam, K. K., Internal Combustion Engines- Theory and practice, Scitech publications India Pvt. Ltd., Chennai, 2000.
3. Khurmi R.S., and Gupta, J. K., A text book of Refrigeration and Air Conditioning, Eurasia Publishing housing (P) Ltd, New Delhi, 2002.
4. Rao, J. S., and Dukkipati, R.V., Mechanism and Machine Theory, Wiley–Eastern Ltd., New Delhi, 1995.
5. Dr. R.K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publications (P) Ltd.

MECHANICAL WORKSHOP LAB (Common to all Branches)	
Course Code: 23ME152/252	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- Study and practice on machine tools and their operations.
- Practice on manufacturing of components using workshop trades includingfitting,
- To study basics of carpentry, foundry and welding.
- Identify and apply suitable tools for machining processes including turning, facing.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.)processes required to manufacture a product from the raw materials.
- Use different measuring, marking, cutting tools used in the workshop.
- Be aware of the safety precautions while working in the workshop.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES		
	CLO1	CLO2	CLO3
CO1	✓	✓	✓
CO2	✓	✓	✓
CO3	✓	✓	
CO4			✓

LIST OF EXPERIMENTS

Fitting Practice:

Use of hand tools in fitting, preparing a male and female joint of M.S. or making a paperweight of M.S.

Carpentry Practice:

Study of Carpentry Tools, Equipment and different joints.

Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint

Smithy

Tools and Equipments –Simple exercises base on smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging, Making simple parts like hexagonal headed bolt, chisel

Welding Practice (Basic Theory to be explained prior topractice):

Gas Welding& Electric Arc welding Practice.

A joint such as a Lap joint, a T-joint or a Butt joint is to be prepared or to make furniture.

Machining (Basic Theory to be explained prior to practice):

(i) Stepped cylindrical Turning of a job and Thread-cutting in lathe. (ii) Shaping (iii) Milling

TEXT BOOKS

1. Laboratory Manual
2. Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice –Theory, practice and workbook", Suma Publications, 2005

REFERENCE BOOKS

1. Kannaiah,P. & Narayanan,K.C. ―Manual on Workshop Practice", Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. ―First year Engineering Workshop Practice", Ramalinga Publications, Madurai, 1999

ENGINEERING GRAPHICS & DESIGN LAB (Common to all Branches)	
Course Code: 23ME153/253	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- Draw orthographic projections of lines, planes and solids.
- Construct isometric scale, isometric projections and views.
- Draw sections of solids including cylinders, cones, prisms and pyramids.
- Draw projections of lines, planes, solids, isometric projections

COURSE LEARNING OUTCOMES (CLO)

Once the course is completed, the students will be able to

- Understand orthographic projections of points and lines in any position through AutoCAD.
- Imagine and convert isometric view into orthographic projections and vice versa.
- Should be able to understand the simple machine components and draw its projections

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES		
	CLO1	CLO2	CLO3
CO1	✓		
CO2		✓	
CO3			✓
CO4			✓

LIST OF EXPERIMENTS

Introduction: Auto CAD

Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning Line Conventions layout of the software, standard tool bar/menus and description of most commonly used toolbars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP &LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Coordinate points, axes, poly lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror,rotate, trim, extend, break, chamfer, fillet, curves, constraints. 2 – Sheets

Orthographic Projections:

Introduction, Definitions - Planes of projection, reference line and conventions employed,Projections of points in all the four quadrants, Projections of straight lines (located in Firstquadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.2 – Sheets

Orthographic Projections of Plane Surfaces (First Angle Projection Only):

Introduction,Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method, **only 1-Sheet**

Projections of Solids (First Angle Projection Only):
Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube),prisms, pyramids, cylinders and cones in different positions. 2-Sheets

Sections and Development of Lateral Surfaces of Solids
Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes andTrue shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. 2 – Sheet

Isometric Projection (Using Isometric Scale Only):
Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres. 2-Sheets

TEXT BOOKS:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, Charotar Publishing House,Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, 4th Ed, University Press
3. Engineering Drawing by N.S.Parthasarathy and Vela Murali Oxford University Press

Reference Books

1. Engineering Graphics - K.R. Gopalakrishna, Subash Publishers Bangalore.
2. Graphics for Design and Production-Luzadder Warren J., Duff John M., EasternEconomy Edition, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Computer Aided Engineering drawing, Prof. M. H. Annaiah, New Age InternationalPublisher, New Delhi

SEMESTER – III

ENGINEERING MATHEMATICS – III	
Course Code: 23AS301	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES (CEO)

- To familiarize the students with partial differential equations and their solution, Boundary value problem, Fourier transforms, z- transforms and basic concepts of Linear algebra.
- To solve boundary value problems, Heat and Wave equations.
- To gain good knowledge in the application of Fourier transform.
- To demonstrate understanding Z-transform and analyzing Discrete signals by using Z-transform.
- To understand Vector spaces, and Linear Transformation with it's properties.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Solve different types of partial differential equations.
- Find solutions of boundary value problems including heat and wave equations.
- Apply and analyze Fourier transforms with different applications.
- Evaluate the problems using z-transforms.
- Understand linear algebra and its application to Engineering.

MAPPING COURSE EDUCTIONALOBJECTIVES & COURSE LEARNING OUTCOMES

CLO / CEO	01	02	03	04
01	✓			
02	✓			
03		✓		
04			✓	
05				✓

COURSE CONTENTS

Unit-I: Partial differential equation – I

Formation of partial differential equation by eliminating arbitrary constants and arbitrary functions. Formation of partial differential equation by eliminating arbitrary functions of the form $\varphi(u, v) = 0$. Solution of standard types of first order equations. Solution of standard types of first order equations. Lagrange's linear equation of first order. Linear Homogeneous partial differential equations of second and higher order with constant coefficients. Formation - Solution of standard types of first order equations - Lagrange's equation - Linear homogeneous partial differential and second and higher order with constant coefficients.

Unit-II: Partial differential equation – II

Classification of partial differential equations. Method of separation of variables. One dimensional Wave Equation and its possible solutions. Initial and Boundary value Problems with zero velocity – related problems and Non-zero velocity- related problems. One dimensional heat equation and its possible solutions. Steady state conditions and zero boundary conditions related problems. Introduction to two dimensional heat equation and its possible solutions in steady state. Two dimensional heat equation - Steady state heat flow equation

Unit- III: Fourier Transforms

Fourier Transforms- Elementary properties of Fourier transforms. Fourier Transforms and related problems- Fast Fourier Transform. Fourier Sine Transforms and their properties-problems. Fourier Cosine Transforms and their properties-problems. Convolution Theorem (without proof)-applications. Parseval's Identity (without proof)-applications.

Unit-IV: Z – Transforms

Z Transforms: Definition and properties of Z- Transforms, Inverse Z- Transforms, and Application of Z- Transforms to difference equations.

Unit-V: Vector Spaces

Vectors in two dimensional space and n-dimensional space, Vectors addition and scalar multiplication of Vectors, Vector Spaces: Definition and Examples General properties of vector spaces, Linear combination of Vectors, Linear independence and Linear dependence of Vectors. Linear transformations, linear operators, Properties of Linear Transformation, Algebra of Linear transformation, Matrix Representation of linear transformation, Linear map Associated with Linear Transformation.

TEXT BOOKS

4. E. Kreyszig, Advanced Engineering Mathematics, Wiley-India, 10th Edition, 2017.
5. Grewal B.S., Higher Engineering Mathematics, 44th edition, Khanna Publishers, 2019
6. Gilbert Strang, Introduction to Linear Algebra, Fifth Edition (2016)

REFERENCE BOOKS

1. R.V. Churchill and J. Brown.: "Fourier Series and Boundary Value Problems" McGraw-Hill Book Company 8th edition-2017.
2. M.D. Raisinghania: "Advanced Differential Equations"S. Chand Publishing2018
3. LoknathDebnath, Integral Transforms and their applications, Chapman and Hall/CRC; 2 edition, 2014

PYTHON PROGRAMMING	
Course Code: 23**CAM2009**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES
• To identify and use various in-built functions, operators and statements supported by python.
• To learn how to use lists, tuples, and dictionaries in Python programs and to learn how to identify Python object types.
• To learn how to write or implement control and decision statements in python.
• To implement the real-use cases of the functions in python.
• To learn how to build and package python module for reusability and understand the concepts of file handling.
• To identify the patterns in the given data and learn how to import in-built library and use the matplotlib for the graphical representation.
• To learn the implementation of Machine Learning and learn how to create a model in python.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand the vision of Python from a global context
• Understand the content that how to write loops, decision statements, write functions and pass arguments in Python.
• Learn how to use lists, tuples, and dictionaries in Python programs and to learn how to identify Python object types.
• Learn how to read and write files in Python. Will learn how to create Pandas DataFrames, calculate aggregates, and merge multiple tables.
• Understand how to import in-built library and use matplotlib for graph representation and how regular pattern matching will be done.
• Understand the concepts of algorithm of Machine learning and learn how to train the models.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTROUCTION TO PYTHON** Definition with Real Use Cases, History of Python, How Python is installed, Execution of the basic program of the python, Character set, Token, core Data types, Variables, input(), eval() & print() function, Formatting String, Operators and Expressions.
UNIT-II	**Conditional & Control Statements** Decision Making statements, Conditional Expressions, Boolean type, Boolean

UNIT NUMBER	COURSE CONTENTS
	operators, String Operators, While Loop, For Loop, Nested loop, Break & continue Statement, range() Function.
UNIT-III	**DATA STRUCTURES, FUNCTIONS & OOPS** Syntax and Basics of Functions, Use of functions, Parameters and Arguments, local & global Scope of variable, return statement, recursive function, Str class, inbuilt functions of string, traversal of string, string operator & operations, Creating a list, Tuple, Dictionaries & sets, In-built functions of list, tuple, set & dictionaries, list operators, replacing values in dictionaries, retrieving value from dictionaries, OOPs introduction, classes and objects, methods, operators, inheritance, super() and method() overriding.
UNIT-IV	**FILE HANDLING & DATA ANALYSIS** Need of File Handling, Different modes of file handling, Read/Write text and numbers to/from a file, Directories on a disk, Introduction of Pandas, Data frames, Series, Data analysis using Pandas.
UNIT-V	**DATA HANDLING** Regular Expression Pattern Matching, Parsing Data, Introduction to Regression, Use Cases of Regression, Types of Regression, Exploratory Data Analysis, Correlation Matrix, Visualisation using Matplotlib, Implementation of Linear Regression.
UNIT-VI	**MACHINE LEARNING** Introduction of Machine Learning, Algorithms Random Forest, Support Vector Machine, Random Forest, Build your own model in python and difference between the Random Forest and decision tree.

TEXT/REFERENCE BOOKS
• Ashok Namdev Kamthane, Programming and Problem Solving with Python, Mc Graw Hill Education Publication, ISBN(13):978-93-87067-57-8.
• Allen B. Downey, Think Python, O'Reilly Media
• Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning

Further suggested Readings
• Effective Computation in Physics: Field Guide to Research with Python Anthony Scopatz, Kathryn D. Huff *(O'Reilly, 2015)*
• Python Cookbook , David Beazley & Brian K. Jones *(O'Reilly, 3rd edition, 2013)*

DATA STRUCTURES	
Course Code: 24CS2001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE

1. To understand the concepts of ADTs.
2. To Learn linear data structures – lists, stacks, and queues.
3. To understand non-linear data structures – trees and graphs.
4. To understand sorting, searching and hashing algorithms.
5. To apply Tree and Graph structures.

COURSE LEARNING OUTCOMES (CLO's)

The syllabus adhere to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Define linear and non-linear data structures.
2. Implement linear and non–linear data structure operations.
3. Use appropriate linear/non–linear data structure operations for solving a given problem.
4. Apply appropriate graph algorithms for graph applications.
5. Analyze the various searching and sorting algorithms.

COURSE LEARNING OUTCOME (CLO)-COURSE OBJECTIVE (CO) MAPPING

CLO / CO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**LISTS** Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.

UNIT-II	**STACKS AND QUEUES** Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.
UNIT-III	**TREES** Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.
UNIT-IV	**MULTIWAY SEARCH TREES AND GRAPHS** B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal –– Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm.
UNIT-V	**SEARCHING, SORTING AND HASHING TECHNIQUES** Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort –. Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing.

TEXT BOOKS

- Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
- Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007.

REFERENCE BOOKS

- Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
- Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
- Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

- Theory and problem of programming with C, Byron C Gottfried, TMH.
- Data Structures using C, Reema Thareja, Oxford Publications.
- Data structures and Algorithms Made Easy" 5th edition by Narasimha Karumanchi, Career monk publications

DATABASE MANAGEMENT SYSTEMS	
Course Code: 23CS2005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES

1. To understand the basic concepts and the applications of database systems.
2. To master the basics of SQL and construct queries using SQL.
3. To understand the relational database design principles.
4. To familiarize with the basic issues of transaction processing and concurrency control.
5. To understand the several database concepts like Object Database, Distributed Database, Mobile Database, Temporal Database.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.
2. Design the database schema with the use of appropriate data types for storage of data in database
3. Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.
4. Apply and create Relational Database Design process with Normalization and Denormalization of data. Also, formulate SQL queries on the respect data into RDBMS and on the data.
5. Understand and apply the concept of transaction, concurrency control and recovery in database.
6. Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

COURSE LEARNING OUTCOMES (CLO) - COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓	✓				
CO2			✓			
CO3				✓		
CO4					✓	
CO5						✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION:** Database System Applications, Purpose of Database Systems, View of Data - Data Abstraction, Instances and Schemas, Data Models, Database Languages - DDL, DML, Database Architecture, Database Users and Administrators, History of Data base Systems, Database design , ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises, Relational Model - Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views Destroying/ altering Tables and Views.
UNIT-II	**RELATIONAL ALGEBRA AND CALCULUS:** Relational Algebra - Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus - Tuple relational Calculus - Domain relational calculus - Expressive Power of Algebra and calculus. Form of Basic SQL Query - Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set - Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values - Logical connectives - AND, OR and NOT - Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.
UNIT-III	**NORMALIZATION:** Introduction to Schema Refinement - Problems Caused by redundancy, Decompositions - Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST, SECOND, THIRD Normal forms - BCNF - Properties of Decompositions - Loss less join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design - Multi valued Dependencies - FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.
UNIT-IV	**TRANSACTIONS & RECOVERY:** Transaction management: ACID Properties, Transaction states, Concurrency control: Concurrency Control –Overview, Concurrency control problems, Locks, Locking Protocols, Deadlocks, Serializability, Recovery System: Types of Failures, Recovery Techniques.

UNIT NUMBER	COURSE CONTENTS
UNIT-V	**CURRENT TRENDS:** Object DBMS- Distributed Database- Parallel Database- Mobile database- Geographic Information system-Multimedia Database- Temporal Database- Data Warehousing and Data Mining.

TEXT BOOKS

- S.K. Singh, Database Systems: Concepts, Design and Applications, Pearson Education India, 2009
- Thomas Connolly, Carolyn Begg. Database Systems, 3rd Edition – Pearson Education.
- Korth, Silberschatz, Database System Concepts, 4th Ed., TMH, 2000.
- Date C. J., An Introduction to Database Systems , 7th Ed., Narosa Publishing, 2004.

REFERENCE BOOKS

- Elmasri Navathe, Fundamentals of Database Systems, 5th Edition Pearson Education.
- M.Tamer Ozsu , Patrick Ualduriel, "Principles of Distributed Database Systems", Second Edition, Pearson Education, 2003.
- Vipin.C.Desai , An introduction to Database System , West Pub. Co

COMPUTER ARCHITECTURE & ORGANIZATION	
Course Code: 24CSPE2007	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE

1. To impart the basic concepts of component, architecture and register organization.
2. To understand concepts of data representation and binary value implementation using arithmetic algorithms.
3. To teach the students how to describe machine capabilities and design an effective data path of control unit
4. To provide knowledge of memory technologies, interfacing techniques and sub-system.
5. To make students understand the importance of IO interfacing techniques and their performance metrics for a typical computer.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode.
2. Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.
3. Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.
4. Understand the need for an interface and instruction cycle phases. Implement the hardwired and microprogrammed control unit for analyse the performance.
5. Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithm for given design requirements.

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	✓				
CO2		✓	✓		
CO3				✓	
CO4					✓
CO5				✓	

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Evolution of Computer Systems-Computer Types-Functional units-Basic operational concepts-Bus structures- location and addresses-memory operations- Addressing modes-Design of a computer system- Memory Instruction and instruction sequencing, RISC versus CISC.
UNIT-II	**CENTRAL PROCESSING UNIT** Introduction-Arithmetic Logic Unit - Fixed point arithmetic, floating point arithmetic-Execution of complete instruction-Basic concepts of pipelining.
UNIT-III	**CONTROL UNIT DESIGN** Introduction-Control Transfer-Fetch cycle- Instruction Interpretation & Execution, Hardwired control- Micro-programmed control
UNIT-IV	**MEMORIES AND SUBSYSTEMS** Semiconductor memory - Static and Dynamic -Associative memory- Cache memory-Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms Virtual memory-Secondary memories-Optical magnetic tape & magnetic disks & controllers.
UNIT-V	**I/O PROCESSING** Introduction-Data transfer techniques- Bus Interface- I/O Channel-I/O Processor, I/O devices -Direct memory access.

TEXT BOOKS
• Computer Organization and Design - The Hardware/Software Interface-Author D. A. Patterson and J. L. Hennessy publisher Morgan Kaufmann Edition 2014 • Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, V Edition, • Computer System Architecture, Morris Mano, Third edition-2002, Prentice Hall of India Pvt Ltd publications. • Computer Organization and Architecture – Designing for Performance", William Stallings, Ninth edition, Pearson publications.
REFERENCE BOOKS
• Structured Computer Organization, Andrew S. Tanenbaum
• David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface".
• John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill

PYTHON PROGRAMMING LAB	
Course Code: 23CAM2115	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES:-

To impart a sound knowledge on working of the computer involving the different basic concepts of programming oriented topics required for Python Programming.

PROGRAMS:

1. Write a program to perform different Arithmetic Operations on numbers in Python.
2. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
3. Write a program to create, append, and remove lists in python.
4. Write a program to demonstrate working with tuples in python.
5. Write a program to demonstrate working with dictionaries in python.
6. To write a python program that takes in command line arguments as input and print the number of arguments.
7. To write a python program to find the most frequent words in a text file.
8. Create and manipulate one-dimensional and two-dimensional numpy arrays,
9. Show the operations to manipulate pandas Series and Dataframes.
10. Create histograms and scatter plots for basic exploratory data analysis

LEARNING OUTCOME:

On completion of this course, the students will be able to:-

Apply the knowledge of basic python concepts to analyse the data and to derive meaningful results from raw datasets.

Learning Resources	
Reference Book and other materials	**1.** Laboratory Manual

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 23CS2111	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations. And describe the basics of SQL and construct queries using SQL.
3. To emphasize the importance of normalization in databases.
4. To facilitate students in Database design.
5. To familiarize issues of concurrency control and transaction management.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. **Transform** an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.
2. **Use** an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
3. **Formulate** query, using SQL, solutions to a broad range of query and data update problems.
4. Design and implement database applications on their own.
5. Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.
6. Analyze and Select storage and recovery techniques of database system.

COURSE LEARNING OUTCOMES (CLO) - COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓					
CO2		✓	✓			
CO3			✓			
CO4				✓		
CO5					✓	✓

LIST OF EXPERIMENTS

1. Introduction to SQL.

2. To study Basic SQL commands (create database, create table, use , drop, insert) and execute the queries using these commands.
3. To study the viewing commands (select , update) and execute the queries using these commands.
4. To study the commands to modify the structure of table (alter, delete, drop, add, modify) and execute the queries using these commands.
5. To study the commands that involve compound conditions (and, or, in , not in, between , not between , like , not like) and execute the queries using these commands.
6. To study the aggregate functions (sum, count, max, min, average) and execute the queries using these commands.
7. To study the grouping commands (group by, order by) and execute the queries using these commands.
8. To study the commands involving data constraints and execute the queries using these commands.
9. To study the commands for aliasing and renaming and execute the queries using these Commands.
10. To study the commands for joins (cross join, inner join, outer join) and execute the queries using these commands:
11. Study of Integrity Constraints in SQL.
12. Study of Use of Group By and Having Clause.

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

TEXT BOOKS

- Laboratory Manual
- S.K. Singh, Database Systems: Concepts, Design and Applications, Pearson Education India, 2009
- Thomas Connolly, Carolyn Begg. Database Systems, 3rd Edition – Pearson Education.
- Korth, Silberschatz, Database System Concepts, 4th Ed., TMH, 2000.
- Date C. J., An Introduction to Database Systems , 7th Ed., Narosa Publishing, 2004.

REFERNCE BOOKS

- Elmasri Navathe, Fundamentals of Database Systems, 5th Edition Pearson Education.
- M.Tamer Ozsu , Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, Pearson Education, 2003.
- Vipin.C.Desai , An introduction to Database System , West Pub. Co

DATA STRUCTRUES LAB	
Course Code: 24CS2113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

1. To demonstrate array implementation of linear data structure algorithms.
2. To implement the applications using Stack & Queue.
3. To implement Binary search tree and AVL tree algorithms.
4. To implement Prim's algorithm
5. To implement Sorting, Searching and Hashing algorithms.

COURSE LEARNING OUTCOMES (CLO's)

The syllabus adhere to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Implement Linear data structure algorithms.
2. Implement applications using Stacks and Linked lists
3. Implement Binary Search tree and AVL tree operations.
4. Implement graph algorithms.
5. Analyze the various searching and sorting algorithms.

COURSE LEARNING OUTCOME (CLO)-COURSE OBJECTIVE (CO) MAPPING

CLO / CO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

LIST OF EXPERIMENT:

1. Implementation of Singly Linked List
2. Implementation of Polynomial Manipulation using Linked list
3. Linked list implementation of Stack and Linear Queue ADTs
4. Array implementation of Stack, Queue and Circular Queue ADTs
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees

7. Implementation of AVL Trees

8. Implementation of Heaps using Priority Queues

9. Implementation of Dijkstra's Algorithm

10. Implementation of Prim's Algorithm

11. Implementation of Linear Search and Binary Search

12. Implementation of Insertion Sort and Selection Sort

13. Implementation of Merge Sort

TEXT BOOK:

- Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson, Education, 2005.
- Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

REFERENCE BOOKS

- Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
- Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
- Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

INDUSTRY SESSION: DATA SCIENCE LAB	
Course Code: 23CAM2117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of Data Science using Python.
• To introduce the students with the importance of Machine Learning using and importance of their improvement.
• To introduce the students with the importance of Data Visualization in Machine Learning using Python programming.
• To teach the students different tools and libraries of Python Programming so that they can cope up with industry standard and requirements.
• To enable students to have skills that will help them to solve complex real-world problems and introduce them to a new world of problem-solving techniques.

List of Programs

1. Write a python program to check given no. is positive, negative or zero.
2. Write a python program to get the statistical summary and nature of the data of a given data frame.
3. Draw a bar chart of given data set.
4. Write a program to implement Linear Regression algorithm.
5. Write a program to implement Logistic Regression algorithm. Compute the accuracy of the classifier.
6. Write a program to implement k-Nearest Neighbour algorithm to classify data set.
7. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
8. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier.
9. Write a program for clustering using k-Means algorithm.
10. Write a program for clustering using Hierarchical clustering algorithm.

Project Statement

Project Title – Text Message Classification Spam or Ham

How often have we come across messages saying we have won a trip to Hawaii or won a million dollar or won a cash prize. This form of scam through text messages which are generally spam messages is called smishing. A lot of times they ask us to fill in forms and ask our personal information or SSN number which is really fishy or bound to be a fraud. The goal of this project is to use Data Science to accurately classify whether a message is spam or not.

Since not all online reviews are truthful and trustworthy, it is important to develop techniques for detecting review spam. By extracting meaningful features from the text using Natural Language Processing (NLP), it is possible to conduct review spam detection using various machine learning techniques. Additionally, reviewer information, apart from the text itself, can be used to aid in this process. In this project, we survey the prominent machine learning techniques that have been proposed to solve the problem of review spam

detection and the performance of different approaches for classification and detection of review spam.

TEXT/REFERENCE BOOKS
• **IBM Content/Books**
• **Python Data Science Handbook**: Essential Tools for Working with Data by Jake VanderPlas

DIGITAL MARKETING	
Course Code: 24CS0201A	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 Marks
L T P : 0 0 2	
Credits: 1	

TRAINING OBJECTIVES

1.
2.
3.

TRAINING LEARNING OUTCOMES (TLOS) After the completion of training students will be able to:
1.
2.
3.
4.

TRAINING LEARNING OUTCOMES (TLO)-TRAINING OBJECTIVES (TO) MAPPING

	TLO1	**TLO2**	**TLO3**	**TLO4**
TO1	✓			
TO2		✓		
TO3			✓	✓

TRAINING CONTENTS

MODULE	**TRAINING CONTENT**	**STUDENTS ENGAGEMENT ACTIVITY**
I		
II		

MODULE	TRAINING CONTENT	STUDENTS ENGAGEMENT ACTIVITY
III		
IV		
V		

LEARNING RESOURCES
1.

SEMESTER – IV

CLOUD APPLICATION DEVELOPMENT	
Course Code: 23CAM2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 2 0 0	
Credits: 2	

COURSE OBJECTIVES
• To provide an overview of an exciting field of Cloud Computing
• To introduce tools require building, deploying, running and managing applications on a cloud platform.
• To develop the cloud application development skills, such as Node.js, REST architecture, JSON, Cloud Foundry and DevOps services
• To enable students to have skills that will help them to solve complex real-world problems in for decision support.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand the vision of Cloud Computing from a global context.
• Understand various compute options on IBM Cloud by market perspective of Cloud Computing.
• Analyse architecture and implementation of APIs with services of IBM Cloud in Cloud Computing.
• Integrate the Node.js application with Watson services over IBM Cloud.
• Build and create state of the art architecture in Kubernetes cluster.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Introduction to Cloud Computing and IBM Cloud** Definition with Real Time Examples, Introduction to cloud computing and its characteristics, Benefits of cloud, Models of Cloud, IBM Cloud resources, Cloud Foundary concepts
UNIT-II	**DevOps and REST API's with data services on IBM Cloud** What is DevOps? Capabilities of IBM Cloud Continuous Delivery, Architecture of REST, IBM Watson services, Databases types and capabilities, APIs interaction with Cloudant database
UNIT-III	**Developing Cloud Application with Node.js** Introduction to JavaScript, Node.js modules, Synchronous and Asynchronous callback, Introduction to Express framework, Route handling, Middleware functions

UNIT-IV	**Application with IBM Cloud services** Understand business problems and goals, functional and non-functional requirements, IBM Cloud App ID, IBM Cloud monitoring services, Introduction to Async patterns in ECMAScript, Callbacks and Promises
UNIT-V	**React and Introduction to Kubernetes** Introduction to React & its components, React deployment with IBM Cloud, Container orchestration (Kubernetes), Kubernetes building blocks: Pods, Deployment and Service, Building a Kubernetes cluster by using IBM Cloud, Deployment of an application to Kubernetes
UNIT-VI	**PROJECT** Research Activities on Cloud Computing with projects and research letters.

TEXT/REFERENCE BOOKS
• Cloud Computing, A Practical Approach - Anthony T. Velte, CISSP, CISA, is an award-winning author and cofounder of Velte Publishing, Inc. He is the coauthor, with Toby Velte
• Cloud Application Development - Anubhav Hanjura
• OpenStack Cloud Application Development - Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason Robinson

Further suggested Readings
• Cloud Computing Paperback- Temitayo Fagbola

AGILE DEVELOPMENT METHODOLOGY	
Course Code: 24CAF2006	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 2 0 0	
Credits: 2	

COURSE OBJECTIVES
• To provide an overview of Agile Development Methodologies.
• To introduce the students with the importance of Software Development Methodologies and importance of their improvement.
• To teach the students different tools so that they can cope up with industry standard and requirements.
• To enable students to have skills that will help them to solve complex real-world problems and introduce them to a new world of problem-solving techniques.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand the vision of Agile Development Methodologies from a global context.
• Understand and apply Agile in market so that output can be made better for any input.
• Apply and analyses various tools and techniques in order to introduce automation.
• Evaluate the application of Agile in Industrial and Commercial sectors.
• Build and create the service instances using IBM services and setting up the DevOps on IBM Cloud. Creating projects and research activities based on different principles of AI.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Design Thinking and its Principles** Introduction and Importance of Design Thinking, IBM DT Framework, Empathy Map, As-Is Scenario, Big Idea Vignettes, Prioritization Grid, Story Boards and other tools such as Hills.
UNIT-II	**Project Execution and Agile** Waterfall and V Model – their implementation, Advantages and Disadvantages of both Models. Agile – Overview, Intro Agile Manifesto Agile vs Waterfall, Different Agile Frameworks such as XP, FDD, RUP, TDD, Scrum and Kanban.
UNIT-III	**Scrum – Foundation** Foundation, Scrum Team and Roles in it, Sprints and Definition of Ready, Product Backlog, Sprint Backlog, Sprint Burndown and Impediments List,

UNIT-IV	**Scrum – Deep Dive** Scrum Ceremonies – Daily Scrum meeting, PBR, Sprint Review Meeting. Sprint Goal, User Stories, Definition of Done. Scrum Metrics – Team Velocity, Sprint Burndown Chart, Defect Density.
UNIT-V	**DevOps** Introduction, Agile vs DevOps, CI/CD, GIT, Automation, Configuration Management, Continuous Deployment, Docker, DevOps in Mobile and web application Development, DevOps in IOT. Introduction to IBM Cloud and Cloud Services
UNIT-VI	**PROJECT** Implementation of Docker, Git and other automation tools.

TEXT/REFERENCE BOOKS
• **IBM Content/Books**

THEORY OF COMPUTATION	
Course Code: 23CSPE2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To understand and design various finite Computing models.
2. To understand the basics of regular expression and its equivalence.
3. To gain knowledge about the concepts of grammar, normal forms.
4. To study the concepts of Push Down Automata and its applications.
5. To understand the recursive and recursively enumerable languages , decidability and undecidability of various problems.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy-2020 (NEP). After completion of course, students would be able to:
1. Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.
2. Design regular expressions to define simple and complex search criteria.
3. Disambiguate context-free grammars by mastering the concepts of context- free languages.
4. Design PDA to recognize context free grammars.
5. Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**BASIC COMPUTATIONAL CONSTRUCTS**

UNIT NUMBER	COURSE CONTENTS
	Finite State Systems, Basic Definitions Non-Deterministic finite automata(NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA Finite automata with Ɛ-moves, minimization of finite Automata, Concept of basic Machine, Properties and limitations of FSM, Moore and Mealy Machines, Equivalence of Moore and Mealy machines, pumping lemma.
UNIT-II	**REGULAR EXPRESSIONS** Regular grammars, regular expressions, equivalence between regular languages, properties of regular languages, Regular Expressions, Equivalence of finite automata and Regular Expressions, Regular expression conversion and vice versa. Conversion of NFA to DFA by Arden's Method.
UNIT-III	**GRAMMAR** Context Free Languages – Leftmost and rightmost derivation, parsing and ambiguity, Chomsky Hierarchy, LR(k) Grammars, properties of LR(k) grammars, Simplification of CFG, Normal forms
UNIT-IV	**PUSHDOWN AUTOMATA** Pushdown Automata –Definition, Instantaneous Description, Applications of Pushdown Machines, NDPDA and DPDA, Equivalence: PDA to CFL and vice-versa, pumping lemma for CFL..
UNIT-V	**TURING MACHINES & COMPUTATIONAL COMPLEXITY** Turing Machines- Introduction, Definition, Instantaneous Description, Turing machine as Acceptors, Halting problem of T.M., Undecidability: Basics, Post's Correspondence Problem, Rice's Theorem, Properties of Recursive and Recursively Enumerable Languages, Introduction to NP-Hardness and NP-Completeness.

TEXT BOOKS

- E. Hopcroft and J. D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson, Education Publishers, 2nd Edition, 2004

REFERENCE BOOKS

- Michael Sipser, "Introduction to the Theory of Computation", Thomson Asia, 2004
- J.C.Martin, "Introduction to Languages and Theory of Computation", McGraw Hill,2003.
- K.L.P. Mishra, N.Chandrasekaran , " Theoretical Computer Science ", PHI, 3rd Edition, 2007

OPERATING SYSTEMS	
Course Code: 24CS2006	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES

1. To understand the main components of an OS & their functions.
2. To study the process management and scheduling.
3. To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.
4. To understand the concepts and implementation Memory management policies and virtual memory.
5. To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Understand the basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.
2. Understand the process management policies and scheduling of processes by CPU .
3. Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading.
4. Describe and analyze the memory management and its allocation policies.
5. Identify use and evaluate the storage management policies with respect to different storage management technologies.

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

CLO / CO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓	✓		
CO3		✓	✓		
CO4				✓	✓
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
	Operating system overview-objectives and functions, Concept of Multitasking, multiprogramming, multi user, Multithreading etc. Types of Operating Systems: Various Operating system services, architecture. **Linux Kernel - Designer Perspective-** Concept of FOSS - Free & Open-Source Software, Comparative analytics of various modern OS, Introduction to UNIX system kernel, major building blocks, Dual Mode of nature, Processing environment, OS services, System calls, OS as a Resource Manager, Kernel Data Structures, introduction to various subsystems, Micro Kernel
UNIT-II	**PROCESSES & SCHEDULING** Process concept, process scheduling, operation on processes; CPU scheduling, scheduling criteria, scheduling algorithms. Process Synchronization: Critical section Problem, Classical synchronization Problem
UNIT-III	**CONCURRENCY** Principles of concurrency - mutual exclusion, semaphores, monitors, Readers/Writers problem; Deadlocks – prevention- avoidance – detection
UNIT-IV	**MEMORY** Logical Physical Address Space, swapping, contiguous memory allocation, non-contiguous memory allocation paging and segmentation techniques, segmentation with paging; virtual memory management - Demand Paging & Page-Replacement Algorithms; Demand Segmentation.
UNIT-V	**INPUT/OUTPUT AND FILE SYSTEMS** I/O management and disk scheduling – I/O devices, organization of I/O functions: disk scheduling, File management – organization, directories, file sharing, record blocking, secondary storage management, Raid, external security, operational security, password protection, access control, security kernels, hardware security, layered approach.

TEXT BOOKS
• William Stallings, "Operating Systems – internals and design principles", Prentice Hall India, 5th Edition, 2005. • Design of the Unix Operating System By Maurice Bach, PHI
• Silberschatz, Peter Galvin, "Operating System Concepts", AWL 6 th Edition, 2002,.
REFERENCE BOOKS
• Andrew S. Tannenbaum & Albert S. Woodhull, "Operating System Design and Implementation", Prentice Hall India, 2 nd Edition, 1998.
• Ida M. Flynn, Ann Mclver McHoes, "Understanding Operating Systems", 3 rd Edition,Thomson Learning 2001s
• Gary Nutt, "Operating System - A Modern Perspective", Pearson Education Asia, 2 nd Edition 2000. Harvey .M. Deitel, "Operating Systems", 2nd Edition , 2000.

ANALYSIS AND DESIGN OF ALGORITHMS	
Course Code: 24CSPE**2008**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES (CO's)

1. To analyze the asymptotic performance of algorithms and to write rigorous correctness proofs for algorithms.
2. To demonstrate a familiarity with major Divide and conquer algorithms and data structures.
3. To apply important Dynamic programming design paradigms and methods of analysis.
4. To demonstrate through examples greedy design paradigm.
5. To Synthesize efficient algorithms in common engineering design situations

COURSE LEARNING OUTCOMES (CLO's)

The syllabus has been prepared in accordance with National Education Policy-2020 (NEP). After completion of course, students would be able to:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
3. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
4. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

COURSE LEARNING OUTCOMES (CLO's)-COURSE OBJECTIVES (CO's) MAPPING

CLO's / CO's	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** **Algorithm analysis:** Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – **searching:** linear search, binary search and Interpolation Search, Pattern search: The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. **Sorting:** Insertion sort – heap sort.
UNIT-II	**GRAPH ALGORITHMS** **Graph algorithms:** Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm **Network flow:** Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.
UNIT-III	**ALGORITHM DESIGN TECHNIQUES** **Divide and Conquer methodology:** Finding maximum and minimum - Merge sort - Quick sort **Dynamic programming:** Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem – Optimal Merge pattern — Huffman Trees.
UNIT-IV	**STATE SPACE SEARCH ALGORITHMS** **Backtracking:** n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem
UNIT-V	**NP-COMPLETE AND APPROXIMATION ALGORITHM** **Tractable and intractable problems:** Polynomial time algorithms – Venn diagram representation -NP-algorithms - NP-hardness and NP-completeness– Bin Packing problem - Problem reduction: TSP – 3-CNF problem. **Approximation Algorithms:** TSP - **Randomized Algorithms:** concept and application - primality testing - randomized quick sort - Finding kth smallest number

TEXT BOOKS

- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++"

Orient Blackswan, 2nd Edition, 2019.

- Richard Johnsonbaugh , Marcus Schaefer , " *Algorithms* " , Pearson Education, 2006 3rd edition

REFERENCE BOOKS

- Aho, Ullman & Hopcraft, "*The Design and Analysis of Algorithms*", Pearson Education, 2001
- S.E.Goodman , S.T.Hedetniemi , "*Introduction to the Design and Analysis of Algorithms*", McGraw Hill , 2002
- Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
- Sara Baase , "*Computer Algorithms - Introduction to design and analysis",* Pearson.
- S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.

CLOUD APPLICATION DEVELOPMENT LAB	
Course Code: 23CAM2120	Continuous Evaluation: 60 Marks
Pre-Requisite : Basic Knowledge of Cloud Services	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of Cloud Computing.
• This course helps us learning practical implementation of the analytics tool environment and how it is transforming the world.
• To teach the students different tools so that they can cope up with industry standard and requirements.
• To enable students to have skills that the user gets expertise in managing the applications on cloud environment.

List of Programs

1. Configuring IBM Cloud account and create an application using Cloud Foundry Service on IBM Cloud.
2. Mention all commands use in IBM cli to push an application from local system to IBM cloud environment.
3. Configuring secure a web-application with single sign-on (APP ID) on IBM cloud.
4. Configuring Cloudant and managing the datasets on IBM Cloud.
5. Configuring Visual Recognition Service with IBM Watson.
6. Configuring IAM (identity access management) service on IBM cloud.
7. Configuring a server to fetch files from local file system using Nodejs.
8. Implementation of containerization using Docker.
9. Implementation of container orchestration using Kubernetes.
10. Creating a Nodejs application using Express Framework.

Project Statement

- Participants can build an application that stores the stocks that application users choose to follow in the database. A serverless function is configured to run every day at a specific time.
- Participants can use IBM Garage Method to guide in the enterprise adoption approach to cloud based solutions.
- The IBM Garage method, used by IBM Services with clients around the world, emphasizes co-creation and frequent iteration.
- Participants can build and deploy a digital bank capable of managing users accounts, transactions, transfers, and bills

TEXT/REFERENCE BOOKS
• **IBM Content/Books**

AGILE DEVELOPMENT LAB	
Course Code: 23CAF2118	Continuous Evaluation: 60 Marks
Pre-Requisite : Software Development Methodologies	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of Agile Development Methodologies.
• To introduce the students with the importance of Software Development Methodologies and importance of their improvement.
• To teach the students different tools so that they can cope up with industry standard and requirements.
• To enable students to have skills that will help them to solve complex real-world problems and introduce them to a new world of problem-solving techniques.

List of Programs

1. For Designing a better way for cab booking from start to finish. Create a List of Stake holders, Empathy Map and As-is Scenario Map
2. In Above case discussed in practical I, create Big Idea Vignettes, Prioritization grid and Need statements.
3. For the same case create story board, Hills.
4. Create a To-be Scenario for the case discussed in Practical I.
5. Create a 2-3 Sprint with entire team.
6. Installation of Ubuntu on virtual machine.
7. Installation of GIT and Creating GIT Repository.
8. Installing Docker and Creating Docker Image
9. Testing Using Junit
10. Setting up DevOps on IBM Cloud

Project Statement

- Imagine that Samira lives in a remote village in Nepal. It's winter and freezing sleet pounds the nearby roads, making them nearly impassable. Samira just had her first baby, a little girl, and she's premature and severely underweight. The room that she is in, while warm to you, feels like an ice-bath to the baby. Without help soon, she will almost certainly die from hypothermia. Explain with empathy map and scenario mapping.
- Dealing with medication can often be a bigger pain than the ailment itself. Standing in long lines at the pharmacy, keeping up with expiration dates, making sure you take this medicine with food and that one on an empty stomach—it can be overwhelming. An online pharmacy called PillPack had a mission to make it easier. PillPack worked to build a prescription home-delivery system that takes the pain out of the whole process. The venture brought their business to IDEO's Cambridge office as a startup-in-residence and worked with designers to fine-tune their offer and showcase it to the world. Brainstorm the ideas and represent the most suitable idea in the form of Storyboarding.

TEXT/REFERENCE BOOKS
• **IBM Content/Books**

OPERATING SYSTEMS LAB	
Course Code: 23CS2114	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To understand the operating system principles and its implementations.
2. To understand the main components of an OS & their functions.
3. To provide necessary skills for developing and debugging programs in order to optimize performance of OS.
4. To study the process management and scheduling.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate the various operations of file system.
2. Understand and Implement Memory management schemes, Thread and synchronization
3. Implement Deadlock algorithms and page replacement algorithms.
4. Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.
5. Implement Scheduling algorithms.

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓	✓	
CO4					✓

LIST OF PROGRAMS

1. Write a program to implement CPU scheduling for first come first serve.
2. Write a program to implement CPU scheduling for shortest job first.
3. Write a program to perform priority scheduling.
4. Write a program to implement CPU scheduling for Round Robin.
5. Write a program for page replacement policy using a LRU
6. Write a program for page replacement policy using FIFO.
7. Write a program for page replacement policy using Optimal.

8. Write a program to implement first fit, best fit and worst fit algorithm for Memory management.
9. Write a program to implement reader/writer problem using semaphore.
10. Write a program to implement Banker's algorithm for deadlock avoidance.

TEXT BOOKS

1. Abraham Silberschatz Peter B. Galvin and Greg Gagne, Operating System Concepts, Wiley 8th Edition, 2008.
2. Garry. J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley
3. Andrew S. Tanenbaum and Herbert Bros, Modern Operating Systems (4th Edition), Pearson

REFERENCE BOOKS

1. William Stallings, "Operating Systems – internals and design principles", Prentice Hall India, 5 th Edition, 2005.

ALGORITHMS LAB	
Course Code: 24CSPE2118	Continuous Evaluation: 60 Marks
Pre-Requisite : C Programming Language	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

6. To understand and apply the algorithm analysis techniques on searching and sorting algorithms.
7. To critically analyze the efficiency of graph algorithms.
8. To understand different algorithm design techniques.
9. To solve programming problems using state space tree.
10. To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

COURSE LEARNING OUTCOMES (CLO's)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Analyze the efficiency of algorithms using various frameworks.
2. Apply graph algorithms to solve problems and analyze their efficiency.
3. Implement various techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.
4. Analyze & Use the state space tree method for solving problems.
5. Apply problems solving using approximation algorithms and randomized algorithms.

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

LIST OF EXPERIMENT:

1. Write a program to Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.

2. Implement recursive Binary Search. Determine the time required to search an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
3. Develop a program to implement graph traversal using Breadth First Search.
4. Develop a program to implement graph traversal using Depth First Search.
5. Develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
6. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
7. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
8. Write a program to perform Quick Sort for the given list of integer values.
9. Write a Program to perform Merge Sort on the given two lists of integer values.
10. Implement N-Queens problem using Backtracking.
11. Write a program to solve Sum of subsets problem for a given set of distinct numbers.
12. Implement fractional knapsack problem using Greedy Strategy.
13. Implement Travelling Salesman Problem.
14. Implement randomized algorithms for finding the k^{th} smallest number.

TEXT BOOK:

- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
- Richard Johnsonbaugh, Marcus Schaefer, " Algorithms ", Pearson Education, 2006 3rd edition

REFERENCE BOOKS

- Aho, Ullman & Hopcraft, "The Design and Analysis of Algorithms", Pearson Education, 2001
- S.E.Goodman, S.T.Hedetniemi, "Introduction to the Design and Analysis of Algorithms", McGraw Hill , 2002
- Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
- Sara Baase, "Computer Algorithms - Introduction to design and analysis", Pearson.
- S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.

DESIGN THINKING AND AUGMENTED VIRTUAL REALITY	
Course Code: 24CS0202B	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 Marks
L T P : 0 0 2	
Credits: 1	

TRAINING OBJECTIVES (CO)
1. To recognize the importance of DT.
2. To explain the phases in the DT process.
3. To familiarize the students with the Augmented Virtual Reality Environment.
4. To establish and cultivate a broad and comprehensive understanding of this rapidly evolving and commercially viable field of Computer Science

TRAINING LEARNING OUTCOMES (TLOS) After the completion of training the students will be able to:
1. Understand and critically apply the concepts and methods of business processes.
2. Understand and analyse design thinking history and its various concepts.
3. Understand, analyse and create models with users collaboration to apply design thinking concepts.
4. Understands the role and importance of graphics in VR, AR and MR.
5. Understand the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

TRAINING LEARNING OUTCOMES (TLO)-TRAINING OBJECTIVES (TO) MAPPING

	TLO1	**TLO2**	**TLO3**	**TLO4**	**TLO5**
TO1	✓				
TO2		✓	✓		
TO3				✓	
TO4					✓

TRAINING CONTENTS

MODULE	**TRAINING CONTENT**	**STUDENTS ENGAGEMENT ACTIVITY**
I	**INTRODUCTION TO DT** Recognize the importance of Design Thinking, Identify the steps in the DT process, Recognize the steps in the empathize phase of DT, Identify the steps required to conduct an immersion activity	Product that you loved and hated activity.
II	**DEFINE PHASE OF DT**	Interview people and fill the DT

	Conduct an immersion activity and fill up the DT question template, Recognize the steps to create personas in the define phase of DT, Recognize the steps to create problem statements in the define phase of DT, Define the problem statements in the define phase of DT.	Question template
III	**IDEATE PAHSE OF DT** Recognize the steps in the ideate phase of DT, Apply the steps in the ideate phase of DT, Recognize how doodling can help to express ideas, Recognize the importance storytelling in presenting ideas and protypes, Recognize the importance of the prototype phase in DT.	Ideate a solution for a Given problem.
IV	**INTRODUCTION TO VR and AR** Historical Overview, Current Trends and Future applications of Immersive Technologies, Best practices in VR, AR and Mixed Reality (MR), Categorization of VR and AR techniques, Input and Output devices used in AR and VR. Case Study : Google Lens, ARCore	To study various AR and VR based existing applications.
V	**HANDS ON ACTIVITY** This activity will help the students to identify the importance of an innovative approach : a) Discuss about a product that you like or dislike and identify what they need in a bad product to make it good. b) Design a prototype how AR and VR can be used in Education.	Designing of Solution to the Problem.

LEARNING RESOURCES

1. Hooked by Nir Eyal
2. The Art of Creative Thinking by Rod Judkins
3. Start Up nation by Dan Senor and Saul singer
4. Start with Why by Simon Sinek
5. Kelly S. Hale (Editor), Kay M. Stanney (Editor). 2014. Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition (Human Factors and Ergonomics) ISBN-13: 978-1466511842
6. Michael Madary and Thomas K. Metzinger. 2016. Real Virtuality: A Code of Ethical Conduct.Recommendations for Good Scientific Practice and the Consumers of VR-Technology. Frontiers in Robotics and AI 3, February: 1–23. http://doi.org/10.3389/frobt.2016.00003
7. Jason Jerald. 2015. The VR Book: Human-Centered Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool Publishers. http://doi.org/10.1145/2792790

SEMESTER – V

MACHINE LEARNING USING R	
Course Code: 23CAM3001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES
• To provide an overview of an exciting field of Machine Learning and R Programming
• To introduce the tools required to manage and analyze machine learning like RStudio.
• To teach the fundamental techniques and principles in achieving Machine Learning using R with scalability and streaming capability.
• To enable students to have skills that will help them to solve complex real-world problems in for decision support.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand the vision of Machine Learning and R Programming from a global context.
• Have a good understanding of the fundamental of R Programming. Have an overview of the operators, variables, different data structures, understanding of the two main control structures: decisions and loops and functions etc.
• Design effective data visualizations in order to provide new insights into a research question or communicate information to the viewer.
• Learn Supervised, Unsupervised Machine Learning and relation of statistical modelling to machine learning, Learn to use optimization techniques to find the minimum error in your machine learning model, learn various machine learning algorithms like KNN, Decision Trees, SVM, Clustering in detail.
• Design and implement various machine learning model in a range of real-world applications. Creating projects and research activities based on Machine Learning using R.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Introduction to Machine learning and R:** Concept and history of ML, types of machine learning. Supervised and unsupervised machine learning, Applications of ML. Introduction and History of R Programming.
UNIT-II	**R Programming:** Variables and data types, data structures, Control Statements: If, else, if. Else if and switch statement, loops: for loop, while loop, repeat loop, break and next statement, Functions and string**:** Function, user defined function, Apply family. Data processing: Read data from different format, csv files, Excel files, Xml, json and web scrapping from data base

UNIT-III	**Data Visualization and Basics of Statistics**: Scatter plot, Line chart ,Bar Chart ,Pie Chart ,Histogram, Heat Map Basic Statistical concepts: Measure of center tendency- mean, median and mode, Measure of variability – Variance, Standard deviation and Interquartile range, data distribution Hypothesis testing : Null and alternate hypothesis, statistical test, z-tests, t test, critical reason, critical value one tail and two tail test, Type 1 and type 2 error.
UNIT-IV	**Supervised machine learning:** Regression and classification analysis, Algorithms - Linear Regression, Logistic Regression, Support Vector Machine, KNN, Naïve Bayes, Decision Tree and Random Forest. Model evaluation techniques – MAE, MSE, RMSE, MPE, MAPE, R-square and Adjusted R-Square. Confusion Matrix, Accuracy, Precision, Recall, F-Score and AUC-ROC curve.
UNIT-V	**Unsupervised Learning Techniques** Clustering, K-Means Clustering, Hierarchical Clustering, Agglomerative clustering, Divisive Clustering, Linkage Method, Density-Based Clustering, PCA, Distance Matrices, Euclidean Distance, Manhattan Distance, Minkowiski.
UNIT-VI	**PROJECT** Research Activities on Machine Learning with projects and research letters.

TEXT/REFERENCE BOOKS
• Brett Lantz. Machine Learning with R. 3rd ed. ISBN-13: 978-1788295864.
• R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition. By Hadley Wickham. ISBN-13: 978-1491910399
• Hands-On Programming with R: Write Your Own Functions and Simulations by Garrett Grolemund. ISBN-13: 978-1449359010

Further suggested Readings
• Analytics: Data Science, Data Analysis and Predictive Analytics for Business" by Daniel Covington.
• Machine Learning for Big Data: Hands-On for Developers and Technical Professionals" by Jason Bell.

ESSENTIALS OF HADOOP	
Course Code: 23CAF3005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 2 0 0	
Credits: 2	

COURSE OBJECTIVES
• To provide an overview of an exciting field of big data analytics
• To develop an understanding of the complete open-source Hadoop ecosystem and its near term future direction
• To introduce the tools required to manage and analyze big data like Hadoop, NoSQL MapReduce
• To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
• To enable students to have skills that will help them to solve complex real-world problems in for decision support.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand the vision of Big Data from a globalcontext.
• Understand and apply Hadoop in Market perspective of Big Data.
• Applying and analyzing architecture and APIs with use of Devices, Gateways and Data Management in Big data.
• Evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.
• Build and create state of the art architecture in Big Data. Creating projects and research activities based on Pig, Hive, Pig Latin.

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**BIG DATA** Develop an understanding of the complete open-source Hadoop ecosystem and its nearterm future directions, compare and evaluate the major Hadoop distributions and their ecosystem components both their strengths and their limitations, hands-on experience with key components of various big data ecosystem components and roles in building a complete big data, Future of BigData. Knowledge of data , How to use Biginsight
UNIT-II	**HADOOP** Why Hadoop? What is Hadoop? Hadoop vs RDBMS, Hadoop vs BigData, Types of data, Brief history of Hadoop, Problems with traditional large-scale systems, Requirements for a new approach, Anatomy of a Hadoop cluster.

UNIT-III	**HDFS** Concepts & Architecture, Data Flow (File Read , File Write), Fault Tolerance, Shell Commands, Java Base API, Data Flow Archives, Coherency, Data Integrity, Role of Secondary NameNode, Zookeeper
UNIT-IV	**MAPREDUCE** Theory, Data Flow (Map – Shuffle - Reduce), MapRed vs MapReduce APIs, Programming Mapper, Reducer, Combiner, Partitioner, Implementation of Mahout, R, Sqoop, Yarn, what is flume Flume, architecture of flume , Flume Modes , the overall architecture of Ambari and Ambari' relation to other services and components of a Hadoop cluster, the functions of the main components of Ambari, initiating start and stopservices from Ambari Web Console
UNIT-V	**HIVE AND PIG** List the characteristics of representative data file formats including flat/text files CSV XML JSON and YAML ,Architecture, Installation, Configuration, Hive vs RDBMS, Tables, DDL & DML, Partitioning & Bucketing, Hive Web Interface, Why Pig, Use case of Pig, Pig Components, Data Model, Pig Latin.
UNIT-VI	**PROJECT** Research Activities on Big Data with projects and research letters. (POC on dataset)

TEXT/REFERENCE BOOKS
• Gelman, Andrew, and Jennifer Hill. Data Analysis Using Regression and Multilevel/Hierarchical Models. 1st ed. Cambridge, UK: Cambridge University Press, 2006. ISBN:9780521867061.
• Gelman, Andrew, John B. Carlin, Hal S. Stern, and Donald B. Rubin. Bayesian Data Analysis. 2nd ed. New York, NY: Chapman & Hall, 2003. ISBN:9781584883883
• Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services

Further suggested Readings
• Analytics: Data Science, Data Analysis and Predictive Analytics for Business" by Daniel Covington.
• Machine Learning for Big Data: Hands-On for Developers and Technical Professionals" by Jason Bell.

COMPILER DESIGN	
Course Code: 24CSPE3001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES (COs)
1. To introduce the major concept areas in compiler design and know the various phases of the compiler
2. To understand the various parsing algorithms and comparison of the same
3. To provide practical programming skills necessary for designing a compiler
4. To gain knowledge about the various code generation principles
5. To understand the necessity for code optimization.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
1. Apply the knowledge of LEX & YACC tool to develop a scanner and parser
2. Design and develop software system for backend of the compiler
3. Suggest the necessity for appropriate code optimization techniques
4. Conclude the appropriate code generator algorithm for a given source language
5. Design a compiler for any programming language.

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	Compilers - Analysis of the source program - Phases of a compiler - Cousins of the Compiler - Grouping of Phases - Compiler construction tools - Lexical Analysis - Role of Lexical Analyzer - Input Buffering - Specification of Tokens..
UNIT-II	Role of the parser - Writing Grammars - Context-Free Grammars - Top Down parsing - Recursive Descent Parsing - Predictive Parsing - Bottom-up parsing - Shift Reduce

UNIT NUMBER	COURSE CONTENTS
	Parsing - Operator Precedent Parsing - LR Parsers - SLR Parser - Canonical LR Parser - LALR Parser
UNIT-III	Intermediate languages - Declarations - Assignment Statements - Boolean Expressions - Case Statements - Back patching - Procedure calls.
UNIT-IV	Introduction - Principal Sources of Optimization - Optimization of basic Blocks - DAG representation of Basic Blocks - Introduction to Global Data Flow Analysis - Runtime Environments - Source Language issues - Storage Organization - Storage Allocation strategies - Access to non-local names - Parameter Passing - Error detection and recovery
UNIT-V	Issues in the design of code generator - The target machine - Runtime Storage management - Basic Blocks and Flow Graphs - Next-use Information - A simple Code generator - DAG based code generation - Peephole Optimization

TEXT BOOKS

- Alfred V. Aho, Jeffrey D Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education Asia, 2012.
- Jean Paul Tremblay, Paul G Serenson, "The Theory and Practice of Compiler Writing", BS Publications, 2005.
- Dhamdhere, D. M., "Compiler Construction Principles and Practice", Second Edition, Macmillan India Ltd., New Delhi, 2008.

- D.M.Dhamdhere, "*System Programming and Operating Systems*", 2nd Edition., Tata Mcgraw Hill,1995

REFERENCE BOOKS

- Kenneth C. Louden, Compiler Construction, Principles and Practice, Thomson Books, 2007.
- Aho. A.V & Ullman J.D, "Principles of Compiler Design", Narosa publications, 1985.
- S.S. Muchnick Harcourt Asra," Advanced Compiler Design implementation", Morgan Kauf12man, 1997.
- Anrew W. Appel, "Modern Compiler Implementation in JAVA", Cambridge University Press, 2003.

COMPUTER NETWORKS	
Course Code: 24CSPE3003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model 2. To study data link layer concepts, design issues, and protocols. 3. To gain core knowledge of Network layer routing protocols and IP addressing. 4. To study Session layer design issues, Transport layer services, and protocols. 5. To acquire knowledge of Application layer and Presentation layer paradigms and protocols.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
1. Describe the functions of each layer in OSI and TCP/IP model.
2. Describe the functions of data link layer and explain the protocols.
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network.
4. Describe the Session layer design issues and Transport layer services.
5. Explain the functions of Application layer and Presentation layer paradigms and Protocols.

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INTRODUCTION** **Internet**: A brief History; Internet Standards and Standards organization; OSI Reference Model; TCP/IP Model; Types of Networks : Local Area Networks, Metropolitan Area Networks, Wide Area Network; Topologies: Bus, Star, Ring,

UNIT NUMBER	COURSE CONTENT
	Hybrid, Tree, Complete, Irregular - Topology; Addressing. **Physical Layer** – Analog and digital signal properties: Sinewave, phase, wavelength, Bit rate, Transmission Impairment, Performance measures: Bandwidth, Throughput, Latency, Jitter; Guided and unguided transmission media; Circuit Switching, Packet Switching.
UNIT-II	**DATA LINK LAYERS** Data link Layer design issues: Framing, Error Detection & Correction: Byte and Bit stuffing, Checksum, CRC, Hamming codes; Elementary Data link Protocols- Sliding window Protocols; Media access control – Random Access: Aloha, CSMA, CSMA/CD; Controlled Access: Token Passing, Polling, Reservation; Channelization: TDMA, FDMA, CDMA; Ethernet Standard;
UNIT-III	**NETWORK LAYERS PROTOCOLS** IPV4 Addressing – classful and classless, Network Address Translation, IPV4 Packet format- IPV6 Addressing, IPV6 Packet format; ARP, RARP, DHCP, ICMP and IGMP.
UNIT-IV	**NETWORK ROUTING** LAN interconnecting devices: Hubs, Switches, Bridges, Routers, Gateways; Routing and Forwarding, Routing Table, Intra- and inter-domain routing, Distance vector routing, DVR Instability problem and solutions, RIP, Link State Routing, OSPF, Path Vector Routing, BGP; Virtual Private Networks; Routing-Link State and Distance Vector Routing Protocols- Implementation-Performance Analysis- Packet Tracer. TCP and UDP-Congestion Control-Effects of Congestion-Traffic Management-TCP Congestion Control-Congestion Avoidance Mechanisms-Queuing Mechanisms-QoS Parameters.
UNIT-V	**TRANSPORT & APPLICATION LAYER** Transmission Control Protocol; User Datagram Protocol; Congestion control mechanisms. Application Layer: Email – SMTP, POP, IMAP; FTP, NNTP, HTTP, DNS, WWW , Firewall.

TEXT BOOKS
• Andrew S. Tanenbaum, "Computer Networks", Pearson Fourth Edition, 2005
REFERENCE BOOKS
• Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.
• James F. Kurose and Keith W. Ross, "Computer Networking:A Top-Down Approach Featuring the Internet", Pearson Education, Third Edition 2003.
• William Stallings, "Data and Computer Communication", Seventh Edition, Pearson Education, 2003.

MACHINE LEARNING USING R LAB	
Course Code: 23CAM3115	Continuous Evaluation: 60 Marks
Pre-Requisite : Basics of Python, R and Data Visualization	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of Data Visualization and Machine Learning using R.
• To introduce the students with the importance of Machine Learning using and importance of their improvement.
• To introduce the students with the importance of Data Visualization in Machine Learning using R programming.
• To teach the students different tools of R Programming so that they can cope up with industry standard and requirements.
• To enable students to have skills that will help them to solve complex real-world problems and introduce them to a new world of problem-solving techniques.

List of Programs

1. Write an R program to check given no. is positive, negative or zero.
2. Write an R program to get the statistical summary and nature of the data of a given data frame.
3. Draw a bar chart that shows cylinder num grouped by number of gear.
4. Write a program to implement Linear Regression algorithm.
5. Write a program to implement Logistic Regression algorithm. Compute the accuracy of the classifier.
6. Write a program to implement k-Nearest Neighbour algorithm to classify data set.
7. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
8. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier.
9. Write a program for clustering using k-Means algorithm.
10. Write a program for clustering using Hierarchical clustering algorithm.

Project Statement

Project Title – Text Message Classification Spam or Ham

How often have we come across messages saying we have won a trip to Hawaii or won a million dollar or won a cash prize. This form of scam through text messages which are generally spam messages is called smishing. A lot of times they ask us to fill in forms and ask our personal information or SSN number which is really fishy or bound to be a fraud. The goal of this project is to use Data Science to accurately classify whether a message is spam or not.

Since not all online reviews are truthful and trustworthy, it is important to develop techniques for detecting review spam. By extracting meaningful features from the text using Natural Language Processing (NLP), it is possible to conduct review spam detection using various machine learning techniques. Additionally, reviewer information, apart from the text itself, can be used to aid in this process. In this project, we survey the prominent machine learning techniques that have been proposed to solve the problem of review spam

detection and the performance of different approaches for classification and detection of review spam.

TEXT/REFERENCE BOOKS
• **IBM Content/Books**
• **Hands-On Programming with R**: Write Your Own Functions and Simulations by Garrett Grolemund. ISBN-13: 978-1449359010

HADOOP LAB	
Course Code: 23CAF3113	Continuous Evaluation: 60 Marks
Pre-Requisite : Linux and SQL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of an exciting field of big data analytics
• Develop an understanding of the complete open-source Hadoop ecosystem and its near term future direction
• To introduce the tools required to manage and analyze big data like Hadoop, NoSQL MapReduce
• To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
• To enable students to have skills that will help them to solve complex real-world problems in for decision support.

List of Programs

1. **Implement the following file management tasks in Hadoop: Adding files and directories**
   - **Retrieving files**
   - **Deleting files**
   - **Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.**
2. **Install and Run Hive then use Hive to create,load, alter, and drop databases, tables.**
3. **Implement Hive Partitioning with data set**
4. **Implement Hive bucketing with data set.**
5. **Implement sqoop commands**
6. **Run a basic Word Count Map Reduce program to understand Map Reduce paradigm with data set.**
7. **Implement Hbase commands with data set..**
8. **Install and Run Pig then write Pig Latin scripts to sort, group, join and filter your data.**
9. **Explore Zookeeper**
10. **Explore Ambari**

Project Statement : Working on Proof of Concept For example we want to analyze You tube data then problem statement will be :

1) Find out the top 5 categories in which the most number of videos are uploaded.
2) Find top 10 rated videos,
3) Find top 10 most viewed videos
4) Find the number of videos with rating less than 1

TEXT/REFERENCE BOOKS
• **IBM Content/Books**

COMPUTER NETWORKS LAB	
Course Code: 24CSPE3113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To learn about packet sniffing.
2. To observe and explore various network protocols by "seeing them in action".
3. To learn about client server programming approach for network communication.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand and learn how to determine the network statistics of their machines.
2. Learn about the working of a packet sniffer that is Wireshark.
3. Understand the in-depth working and role of network protocols.
4. Design and understand the working of TCP three way handshaking protocol.
5. Design and understand UDP based applications.

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓	✓			
CO2			✓		
CO3				✓	✓

LIST OF PROGRAMS

1 Study of Basic Network Commands, Demo session of all networking hardware and Functionalities .
2 Observing Packets across the network and Performance Analysis of Routing protocols
3 Basic Router Configuration (Creating Passwords, Configuring Interfaces)
4 Flow control mechanisms
5 Implementing an IP Addressing Scheme
6 Simulation of Transport layer Protocols and analysis of congestion control techniques in network
7 Develop a DNS client server to resolve the given host name or IP address.
8 Single-Area OSPF and Multi-Area Link Costs and Interface.
9 Configuring WEP on a Wireless Router
10 Configuring Ethernet and Serial Interfaces
11 Planning Network-based Firewalls 25 Configuring a Cisco Router as a DHCP Server

Note:

1. **Students can use any programming language for writing the programs.**
2. **5 or more exercises can be given by the Faculty.**

TEXT BOOKS

1. Andrew S. Tanenbaum, "Computer Networks", Pearson Fourth Edition, 2005.
2. Computer Networking: A Top-Down Approach Featuring the Internet, 5th Ed. (2010), by James F. Kurose and Keith W. Ross. Covers similar material to Peterson and Davie.

REFERENCE BOOKS

1. Computer Networks: A Systems Approach, 4th Ed. (2007), by Larry Peterson and Bruce Davie. Covers background networking material with which students should have familiarity.

LIVE PROJECT-I & INDUSRIAL TRAINING	
Course Code: 23CS0303A	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

To provide hands-on experience at site where Computer Science and engineering projects are executed.

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2
CO1	✓	✓

LIVE PROJECT-I

Students have to undergo six weeks practical training at the end of fourth semester in Computer Science and Engineering related project sites or with the faculty members of parent or any other institute of repute. At the end of the training they have to submit a report together with a certificate in the format prescribed and make a power point presentation which shall be evaluated.

COMPILER DESIGN LAB	
Course Code: 24CSPE3117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To be practically exposed to the compiler writing tools.
2. To be able to design and analyze the compiler.
3. To design a symbol table.
4. To implement various Parsing techniques.
5. To understand the basic steps for designing a compiler.

COURSE LEARNING OUTCOMES (CLOs):-

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.
2. Learn application of different compiler writing tools to implement the different Phases of compiler.
3. Work in the development phase of new computer languages in industry and designing symbol tables.
4. Design Top-down, Bottom-up parsing Techniques.
5. Learn the process of translating a modern high-level language to executable code

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

LIST OF PROGRAMS

1. Implementation of Symbol Table.

2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool.
4. Design a lexical analyzer for a given language and the lexical analyzer should ignore redundant spaces, tabs and newlines.
5. Simulate First and Follow of a Grammar.
6. Develop an operator precedence parser for a given language.
7. Construct a recursive descent parser for an expression.
8. Construct a LL(1) parser for an expression.
9. Design predictive parser for the given language.
10. Implementation of shift reduce parsing algorithm.
11. Design a LALR bottom up parser for the given language.
12. Implement the lexical analyzer using JLex, flex or lex or other lexical analyzer generating tools
13. Write a program to perform loop unrolling.
14. Implementation of LEXR using LLVM.
15. Implementation of handwritten parser using LLVM
16. Generating code with the LLVM backend.
17. Recursive descent parser for the CFG language and implement it using LLVM.
18. LR parser for the CFG language and implement it in the using LLVM

Note: At least 5 more exercises to be given by the teacher concerned.

TEXT BOOKS
• Compilers Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman., Pearson.

REFERENCE BOOKS
• Engineering a Compiler, Second Edition, Keith D. Cooper & Linda Torczon., Morgan Kaufmann, Elsevier.
• Compiler Design, Sandeep Saxena, Rajkumar Singh Rathore., S.Chand publications

SEMESTER – VI

ARTIFICIAL INTELLIGENCE	
Course Code: 23CAM3002	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES
• To provide an overview of an exciting field of Artificial Intelligence
• To introduce the tools required to build and study the services like Watson Assistant and WKS.
• To teach the fundamental techniques and principles in achieving the concepts of machine learning and AI.
• To enable students to have skills that will help them to solve complex real-world problems regarding Artificial Intelligence.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand the vision of AI from a global context.
• Understand and apply IBM Watson Services in Market perspective of Big Data.
• Apply and analyses architecture and APIs with use of WKS and Watson Assistant.
• Evaluate the application of AI and ML in Industrial and Commercial sectors.
• Build and create the service instances using IBM services and using APIs. Creating projects and research activities based on different principles of AI.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Artificial Intelligence Overview** Eras of Computing, types & main focus of AI, ML & its types, Neural Networks, NLP and processes, Use Cases, Computer Vision tools and use cases, Cognitive Computing, Setting up of IBM Bluemix Account.
UNIT-II	**Artificial Intelligence Foundation** IBM Watson and real-world problems, Deep QA Architecture, Commercialization of Watson, Watson Services – capabilities of each Watson service, Watson Knowledge Studio, Usage of Watson API explorer.
UNIT-III	**NLP and NLC** NLP – Processes, Tools and services of NLP, NLP Use cases, Different components of NLP, Challenges with NLU, NLP Pipeline. Capabilities of IBM Watson NLC, NLU and its capabilities, Watson Tone Analyzer, Watson Discovery Service, Using Discovery API
UNIT-IV	**Chatbots**

	Chatbot and its applications, growing popularity of chatbots, tools and services for chatbots, Workspace, Intent, entity and dialog nodes. Nodes in a dialog, Advanced Features of a chatbot, Creation of Watson Assistant Instance, Add Intents and test in slack.
UNIT-V	**Computer Vision** CV – history and advancement with AI, CU Use Cases, Pipeline with in a CV application, Feature Extraction, image classification and recognition, IBM Visual Recognition Service.

TEXT/REFERENCE BOOKS
• **Elaine A Rich, "Artificial Intelligence",** Tata McGraw-Hill Publishing Company Limited.
• **Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems",** Shroff Publishers & Distributors Pvt. Ltd.

Further suggested Readings
• "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig.
• "Artificial Intelligence: A New Synthesis" by Nils J Nilsson.

NOSQL and MongoDB	
Course Code: 24CAF3010	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES (COs)
• To provide an overview of NOSQL and Learn what is MongoDB database and how to work with data stored in JSON or BSON format.
• To learn the basic operations to create and query the database.
• To learn to create, read, update and delete the documents in a database and complex queries.
• To develop an understanding of the advanced MongoDB concepts like Mapreduce, Data Aggregation, Indexing, Replication and the tools required to manage and analyze big data.
• To teach the fundamental techniques of sharding and principles in achieving data processing with scalability. To enable students to have skills that will help them to solve complex real-world problems for decision support.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
• Understand the need of NoSQL database, its types and how it differs from RDBMS. Learning about MongoDB, it's installation and when to apply MongoDB with Market perspective of Big Data.
• Understanding basic MongoDB operations and working of Mongo Shell environment.
• Learn to create and manipulate documents in MongoDB. Master the use of Create, Read, Update and Delete (CRUD) operations.
• Learning the creation of Aggregation pipeline and how to visualize MongoDB data. Evaluate the application of MongoDB in Industrial and Commercial Building Automation, evaluating Data performance using MapReduce and Real-World Design Constraints.
• Learn to scale the database. Build and create fundamental concepts in the context of a connectivity and scalability in MongoDB.

COURSE LEARNING OUTCOMES (CLOS)-COURSE OBJECTIVES (COS) MAPPING

CLO / CO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT	**COURSE CONTENTS**

NUMBER	
UNIT-I	**INTRODUCTION TO NOSQL ARCHITECTURE WITH MONGODB** What in NoSQL?, Difference between NoSQL and RDBMS,Pros and Cons of NoSQL, CAP Theorem, Different data models of NoSQL, What is MongoDB? Installation and Configuration, MongoDB Data Modelling, Creating a Database, Collection and Document, MongoDB Use Cases
UNIT-II	**MONGODB OPERATORS AND MONGODB SHELL** Query & Projection Operator, MongoDB Update Operator, MongoDB limit(), MongoDB sort(), Query Modifiers, MongoDB Shell , Data Types in Mongo Shell
UNIT-III	**MONGODB CRUD OPERATIONS** Inserting and saving documents , CRUD operations (Creating, Reading, Updating and Deleting Data), Limitations in querying data, Query for All Documents in a Collection, Query by a Top Level Field, Query by a Field in an Embedded Document Query by a Field in an Array
UNIT-IV	**ADVANCED MONGODB** Data Aggregation , Aggregation framework,MapReduce, Indexing, Types of Indexes, Query Profiling and the Query optimizer, Replication via Replica Sets
UNIT-V	**SCALABILITY AND CONNECTIVITY OF MONGODB** Horizontal Scalability, What is Sharding concept, Shardkey and Chunks, Sharding components, Types of Sharding, Java MongoDB, Python MongoDB

TEXT/REFERENCE BOOKS
• Steve Hoberman, "Data Modelling for Mongo DB", First Edition,Technics Publication, 2014, ISBN 9781935504702.
• Daniel Perkins, "Mongo DB, Third Edition, CreateSpace Independent Publishing Platform, 2016, ISBN 152396300

Further suggested Readings
• Shakuntala Gupta Edward, "Practical Mongo DB ", Second edition, Apress Publications, 2016, ISBN 1484206487.
• David Hows, "The definitive guide to MongoDB", 2nd edition, Apress Publication, 2009, 8132230485..

SOFTWARE ENGINEERING	
Course Code: 24CSPE**3004**	Continuous Evaluation: 40 Marks
Pre-Requisite : Concept of OOP and Methodology	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES

1. To analyse different software development process models.
2. To extract and analyse software requirements specifications for different projects.
3. To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects
4. To gain knowledge of the system analysis and design concepts.
5. To apply different testing and debugging techniques and analysis their effectiveness.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Analyze software development process models, including agile models and traditional models like waterfall. Acquire knowledge about the concepts of application of formal specification.
2. Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model.
3. Apply testing principles on software project and understand the maintenance concepts.
4. Identify risks, manage the change to assure quality in software projects.
5. Think critically about ethical and social issues in software engineering for different applications

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3		✓	✓		
CO4			✓	✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software life cycle models: Build and Fix,

UNIT NUMBER	COURSE CONTENTS
	Waterfall, Prototype, Iterative Enhancement Model, Evolutionary and Spiral model, V Model & RAD Model.
UNIT-II	**SOFTWARE REQUIREMENTS & QUALITY ASSURANCE** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.
UNIT-III	**SOFTWARE DESIGN CONCEPT** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.
UNIT-IV	**SOFTWARE TESTING** Software Testing: Testing functions, Test case design, White Box testing: cyclomatic complexity, Black box testing: Boundary value Analysis, Equivalence class partitioning, Unit testing, Integration Testing, System testing, Alpha Testing, Beta Testing and Acceptance Testing..
UNIT-V	**SOFTWARE MAINTENANCE & RELIABILITY ISSUES** Need for Maintenance, Categories of Maintenance, The Maintenance Process, Maintenance Models: Quick fix, Iterative Enhancement, Reuse Oriented. Reverse Engineering, Software RE-engineering, Configuration Management. Software Reliability: Failure and Faults, Software reliability Vs Hardware reliability, Classification of Failures, Software reliability metrics.

TEXT BOOKS
• Richard Fairley, "Software Engineering Concepts", McGraw Hill, 2017
• Roger S. Pressman, "Software Engineering A Practitioner Approach" 4th edition , McGraw Hill, 1999
REFERENCE BOOKS
• Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000
• Pankaj Jalote- An Integrated Approach to Software Engineering, Springer Verlag, 1997.
• Shooman, Software Engineering, McGraw Hill, 1983.
• Fundamentals of Software Engineering by Rajib Mall, – PHI-3rd Edition, 2009

ARTIFICIAL INTELLIGENCE LAB	
Course Code: 23CAM3116	Continuous Evaluation: 60 Marks
Pre-Requisite : Python and Machine Learning	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of Artificial Intelligence.
• To introduce the students with the importance of AI and its capability in solving the real-world problems.
• To teach the students different tools so that they can cope up with industry standard and requirements.
• To enable students to have skills that will help them to solve complex real-world problems and introduce them to a new world of problem-solving techniques using AI and python.

List of Programs

1. To create IBM cloud account and understand different IBM Watson Services.
2. To create an AI virtual assistant.
3. To understand different modules used in python for data analysis.
4. To understand and implement Linear Regression algorithm.
5. To Classifying images using Node-Red Guide.
6. Building your own translator with AI guide
7. Gaining insights from AIRBnB reviews guide.
8. Creating a Machine Learning model with Knowledge Studio
9. Predict Fraud using AUTO AI guide
10. To understand and implement Text to Speech and Speech to Text Service using IBM Watson

Project Statement

- Use Node-RED and Telegram to create a chatbot translator. The IBM Language Translator service can connect to other IBM services, and these services can be linked to the Telegram application using a Node-RED app. When you link the services, users can easily use the translation app by sending text or voice to your bot. You will be creating a Node-RED boilerplate that's available on IBM Cloud and link Tarkman to a Telegram app as the user interface using Node-RED flows.
- According to Forbes, by 2020 about 1.7 MB of new information will be created every second—for each and every human being on the planet. You will gain insights from actual AirBnB reviews of Manhattan apartments. A typical query from Yelp or other review engines may depict a certain apartment as most desirable to stay at, however, for example, the reviews may not mention that there is a bar nearby and the noise level during closing hours are enough to wake up any of the residents in the vicinity apartments; the Discovery service can surface those concerns.

TEXT/REFERENCE BOOKS
• **IBM Content/Books**

NOSQL AND MONGODB LAB	
Course Code: 23CAF3012	Continuous Evaluation: 60 Marks
Pre-Requisite : Line and Shell Commands, Programming Concepts	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of RDBMS and NOSQL
• To develop an understanding of the advanced MongoDB concepts like Mapreduce, Data Aggregation, sharding
• To introduce the tools required to manage and analyze big data like Hadoop, NoSQL MapReduce
• To teach the fundamental techniques and principles in achieving data processing with scalability
• To enable students to have skills that will help them to solve complex real-world problems in for decision support.

List of Programs

1. Create a database and collection using MongoDB environment. For example a document collection meant for analyzing Restaurant records can have fields like restaurant, restaurant name, customer name, locality, date, cuisine, grade, comments. etc.
2. Experiment with MongoDB comparison and logical query operators - $gt, $gte, $lt, $lte, $in, #nin, $ne, $and, $or, $not.
3. Write a MongoDB query to display the fields restaurant, name, borough and cuisine, but exclude the field _id for all the documents in the collection restaurant.
4. Write a MongoDB query to display the fields restaurant id, name, borough and zipcode, but exclude the field _id for all the documents in the collection restaurant
5. Write a MongoDB query to find the restaurants that achieved a score, more than 80 but less than 100.
6. Write a MongoDB query to find the restaurants which do not prepare any cuisine of 'American ' and achieved a grade point 'A' not belongs to the borough Brooklyn. The document must be displayed according to the cuisine in descending order
7. Write a MongoDB query to implement array based and evaluation query operators -$exists, $type, $mod, $regex.
8. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which contain 'ces' as last three letters for its name.
9. Write a MongoDB query to find the restaurants which do not prepare any cuisine of 'American' and achieved a score more than 70 and not located in the longitude less than -65.754168.
10. Implement user management commands.

Project Statement: Mini project.

Fetch and Stream Pricing Data

Try your hand at an application that uses a MongoDB database to store the price updates of the world's major stock market indices. The primary assumptions are as follows:
The price data is generated randomly

Some arbitrary price data populates the database initially

TEXT/REFERENCE BOOKS
• **IBM Content/Books**

SOFTWARE ENGINEERING LAB	
Course Code: 24CSPE3118	Continuous Evaluation: 60 Marks
Pre-Requisite : A course on "Programming for Problem Solving"	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To understand the concepts and implement the software engineering methodologies in the list of applications given below. Each UML diagram is designed to let developers and customers view a software system from a different perspective and in varying degrees of abstraction. UML diagrams commonly created in RSA visual modelling tools.

2. To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Prepare SRS document, design document, test cases and software configuration management and risk management related document.

2. Develop function oriented and object oriented software design using tools like rational rose.

3. Generate a high-level design of the system from the software requirements

4. Have experience and/or awareness of testing problems and will be able to develop a simple testing report

COURSE LEARNING OUTCOMES (CLO)-COURSE OBJECTIVES (CO) MAPPING

	CLO1	**CLO2**	**CLO3**	**CLO4**
CO1		✓	✓	✓
CO2	✓		✓	✓

LIST OF EXPERIMENTS

Structure Diagram:

1. To display a relationship among the various structures using Class diagram.
2. Manifestation concept of Component Diagram.
3. Network architect process using the Deployment Diagram.

Behavior Diagram:

4. Use-Case Diagram – To display the relationship among actors & Use-cases.
5. Activity Diagram – To display the action states & source transition states.
6. State Machine Diagram – sequence of state response & action on the interaction.

Interaction Diagram:

7. Sequence Diagram – To display the time sequence of objects interactions.
8. Communication Diagram – To display the elements of frame, lifeline, messages.

Case Study :

9. UML interaction overview diagram for online shopping
10. Bank ATM behavioral using state machine diagram
11. Library Domain model using Class diagram

TEXT BOOKS

1. Roger S. Pressman, "Software Engineering A Practitioner Approach" 4th edition , McGraw Hill, 1999
2. Software Engineering- Sommerville, 7th edition, Pearson Education
3. The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education

REFERENCE BOOKS

1. Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000.

INDUSTRY SESSION : DEEP LEARNING LAB	
Course Code: 23CAM3014	Continuous Evaluation: 60 Marks
Pre-Requisite : **linear algebra, probability, basics of machine learning.**	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of Neural Networks.
• To introduce the students with the importance of Deep Learning using and importance of their improvement.
• To introduce the students with the importance of CNN, RNN and LSTM using Python programming.
• To teach the students different tools and libraries of Python Programming so that they can cope up with industry standard and requirements.
• To enable students to have skills that will help them to solve complex real-world problems and introduce them to a new world of problem-solving techniques.

List of Programs

1. Write a program to implement Convolutional Neural Network.
2. Write a program to implement Recurrent Neural Network.
3. Write a program to implement LSTM.
4. Write a program to RBM.

Project Statement

Project Title – Stock Market Prediction

Stock price prediction is one among the complex machine learning problems. It depends on a large number of factors which contribute to changes in the supply and demand. This paper presents the technical analysis of the various strategies proposed in the past, for predicting the price of a stock, and evaluation of a novel approach for the same. Stock prices are represented as time series data and neural networks are trained to learn the patterns from trends. Along with the numerical analysis of the stock trend, this research also considers the textual analysis of it by analyzing the public sentiment from online news sources and blogs. Utilizing both this information, a merged hybrid model is built which can predict the stock trend more accurately.

TEXT/REFERENCE BOOKS
• **IBM Content/Books**
• Deep Learning (Adaptive Computation and Machine Learning series) by Ian Goodfellow

LIVE PROJECT-II & INDUSTRIAL VISIT	
Course Code: 23CS0304A	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

To provide hands-on experience at site where Computer Science and engineering projects are executed.

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2
CO1	✓	✓

LIVE PROJECT-II

Students have to undergo three weeks practical training at the end of fifth semester in Computer Science and Engineering related project sites or with the faculty members of parent or any other institute of repute. At the end of the training they have to submit a report together with a certificate in the format prescribed and make a power point presentation which shall be evaluated.

SEMESTER – VII

DATA SCIENCE	
Course Code: 24CAF4005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
• To provide an overview of an exciting field of Predictive Analytics.
• To introduce the tools required For the Predictive Analytics.
• To review and explore data to look at data distributions and to identify data problems, including missing values.
• To enable students to have skills that will help them to solve complex real-world problems in for decision support.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand how the quantum computing fits the big picture.
• Understand quantum computing industry applications.
• Explain the difference between classical and quantum computing with the importance of IBM Q Network and its strategic partners.
• Explore which companies are betting on quantum and how.
• Explain how quantum-enhanced feature spaces can help with feature mapping and Explore Aqua risk analysis for finance module.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	
UNIT-II	
UNIT-III	
UNIT-IV	
UNIT-V	

TEXT/REFERENCE BOOKS

- IBM Courseware

Further suggested Readings
• IBM Courseware
• Predictive Analytics Mesmerizing & fascinating by ERIC SIEGEL

QUANTUM COMPUTING	
Course Code: 23CAM4003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
• To recall the basics of computer science and algorithms.
• To explore all the parts of a quantum computer and how this fights interference issues.
To explore the specific tasks in which a quantum computer can make a difference.
• To understand the hardware behind the quantum computer.
• To understand the importance of IBM Q Network and its strategic partners.

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand how the quantum computing fits the big picture.
• Understand quantum computing industry applications.
• Explain the difference between classical and quantum computing with the importance of IBM Q Network and its strategic partners.
• Explore which companies are betting on quantum and how.
• Explain how quantum-enhanced feature spaces can help with feature mapping and Explore Aqua risk analysis for finance module.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	
UNIT-II	
UNIT-III	
UNIT-IV	
UNIT-V	
UNIT-VI	.

TEXT/REFERENCE BOOKS
• Computing with Quantum Cats: From Colossus to Qubits **by John Gribbin**

- Quantum Computing for Computer Scientists Noson Yanofsky and Mirco Mannucci

- Quantum Computation and Quantum Information Michael Nielsen and Isaac Chuang.

DEEP LEARNING	
Course Code: 23CS4001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 4 0 0	
Credits: 4	

COURSE OBJECTIVES(COs)

1. To understand the Understand and Apply Traditional Machine Learning Techniques.
2. To master Deep Learning Architectures and learn to develop Convolutional Neural Networks (CNNs).
3. To be able to work with Deep Sequence Models.
4. To explore Deep Unsupervised Learning and demonstrate the use of transfer learning.
5. To demonstrate the working and design principle of deep reinforcement models.

COURSE LEARNING OUTCOMES (CLO's)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Implement and evaluate traditional machine learning models using probability theory and practical programming exercises.
2. Understand the need for deep architectures and their applications in various domains and Explore and implement various CNN architectures.
3. Utilize deep RNNs for applications like automatic image captioning and video-to-text conversion.
4. Understand latent variable models and the use of autoencoders in unsupervised learning and develop deep generative models, including Variational Autoencoders (VAEs) and Generative Adversarial Networks (GANs).
5. Design applications with reinforcement learning.

COURSE LEARNING OUTCOMES (CLOs)-COURSE OBJECTIVES (COs) MAPPING

CLO / CO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Traditional Machine Learning Basics**: Classification and Regression models with examples. **Artificial Neural Network:** Fundamentals of Neural Network and architecture.
UNIT-II	**Deep Architecture:** Need, applications, Hyper-parameters in Deep Neural Networks, Vanishing gradient problem, and ways to mitigate it. **Convolution Neural Network: C**NN Architectures, Application in Image segmentation, Automated Object Detection models.
UNIT-III	**Deep Sequence Models:** Sequence Modeling Problems, Motivation and Applications, Traditional Models: Recurrent Neural Networks, Back-propagation through time; Modern Recurrent Neural Networks: Gated Recurrent Units, Long Short Term Memory (LSTM), Deep Recurrent Neural Networks, automatic image captioning, video to text with LSTM models.
UNIT-IV	**Deep Unsupervised Learning:** Latent variable models, Autoencoders, Deep Generative Modeling: Variational Autoencoders, Generative Adversarial Networks (GANs), Image generation with Generative adversarial networks, **Advance Topic in Deep Learning:** Transfer Learning: Need and motivation, Process, Data Augmentation, Applications.
UNIT-V	**Deep Reinforcement Learning:** Components of an RL - (Agent, Policy, Value function, Model), Deep-Reinforcement Learning Need and Applications, Types of Deep-RL.

TEXT BOOKS

- Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
- Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.

REFERENCE BOOKS

- Machine Learning: An Algorithmic Perspective, Second Edition, Stephen Marsland, Publisher Chapman and Hall/CRC, Edition 2nd
- Introduction to Probability For Data Science, Stanley H. Chan, Publisher Michigan Publishing, Edition, May 2021.
- N.D.Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016.
- Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications.

QUANTUM COMPUTING LAB	
Course Code: 23CAM4007	Continuous Evaluation: 60 Marks
Pre-Requisite : Basic Quantum Mechanism	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To access and navigate IBM Q Experience.
To identify Superposition, Entanglement, and Noise
• To swap the gates of qubits
• To code an Algorithm with Aqua
• To perform calls to Aqua

List of Programs

- Build a Quantum Random Number Generator.
- Implement Grover's Search Algorithm.
- Use Shor's Algorithm to Factor a Number.
- Find the Ground State Energy of a Lithium Hydride Molecule.
- Explore Quantum Hardware with Qiskit Pulse.
- Sort Images Using a Quantum Machine Learning Algorithm.
- Implement IBM Q Experience
- Understand the Superposition, Entanglement, & Noise
- Non-Connected Qubits & Gate Swaps
- Identify Quantum SVM for Classification

Project Statement

Computational projects on quantum computing suitable for students in a junior-level quantum mechanics course are described. In these projects student write their own programs to simulate quantum computers. Knowledge is assumed of introductory quantum mechanics through the properties of spin 1/2. Initial, more easily programmed projects treat the basics of quantum computation, quantum gates, and Grover's quantum search algorithm. These are followed by more advanced projects to increase the number of qubits and implement Shor's quantum factoring algorithm. The projects can be run on a typical laptop or desktop computer, using most programming languages. Supplementing resources available elsewhere, the projects are presented here in a self-contained format especially suitable for a short computational module for physics students.

TEXT/REFERENCE BOOKS
• Computing with Quantum Cats: From Colossus to Qubits.**by John Gribbin.**
• Quantum Computing for Computer Scientists.Noson Yanofsky and Mirco Mannucci.
• Quantum Computation and Quantum Information Michael Nielsen and Isaac Chuang.

DATA SCIENCE LAB	
Course Code: 24CAF4009	Continuous Evaluation: 60 Marks
Pre-Requisite : Knowledge of Analytics and Visualization	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To provide an overview of Predictive Analytics.
• To introduce the business problems to students, they will identify a Problem to address through Predictive Analytics.
• To teach the students different tools so that they can cope up with industry standard and requirements.
• To enable students to have skills that will help them to select appropriate models and model specifications, and apply the respective methods to enhance data – driven decision making related to the business problem.

List of Programs

1. Work with IBM SPSS Modeler.
2. Create a data-mining project to predict churn in telecommunications.
3. Understand the telecommunications data.
4. Set the unit of analysis for the telecommunications data.
5. Integrate telecommunications data
6. Predict churn in telecommunications and cluster customers into segments.
7. Use functions to cleanse and enrich telecommunications data
8. Improve efficiency with telecommunications data.
9. Analyzing data with Watson Studio.
10. Creating a machine learning model with IBM Watson Studio and the AutoAI tool

Project Statement

• **Scenario:** A bank needs to reduce the risk that a loan is not paid back.
• **Approach:**
- Use historical data to build a model for risk.
- Apply the model to customer or prospects who apply for a loan.

A bank experiences problems with customers who do not pay back their loan, which costs the company a significant amount of money. To reduce the risk that loans are not paid back, the bank will use modeling techniques on its historical data to find groups of high-risk customers (high risk of not paying back the loan). If a model is found, then the bank will use that model to attach a risk score to those who apply for a loan. When the risk of not paying back the loan is too high, the loan will not be granted. The dataset includes demographic information and a field that indicates whether the customer has paid back the loan. Typically not all records will be used for modeling, but a sample will be drawn on which models are built.

A business case: A predictive model

- Using one of the modeling techniques available in IBM SPSS Modeler, you can find patterns in the data.
- You can use the predictive model to attach a risk score to current customers or to those who apply for a loan.
- You can also have a decision rule in place to make a yes/no decision about whether an applicant will be granted the loan.

TEXT/REFERENCE BOOKS
• **IBM Content/Books**

INDUSTRY SESSION: BLOCKCHAIN	
Course Code: 23CAM4011	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
• To understand the Blockchain technology and the key concepts like cryptography and cryptocurrency concepts
• To gtain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners
• To interpret the prospects of Blockchain and assess how Blockchain can improve your business standards
• To deploy your private Blockchain on the web where you can visually see your chains & send transactions between nodes
• To infer Hyperledger project, its architecture, APIs and network topology

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
• Understand how blockchain solutions are transforming the industry landscape.
• Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.
• Acquire hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.
• Design and develop for a permissioned blockchain.
• Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Blockchain prerequisites and Introduction to Blockchain** Introduction to HTML 5 and Javascript Programming, Concept of callback, promises and Async/Await, NodeJS- Server side Javascript, Docker essentials, Containers Orchestration, Implementations Creating and Deplooying Docker containers, Introduction to Blockchain
UNIT-II	**Blockchain in detail and Blockchain Status** Understand the business context behind blockchain and the problems that blockchain aims to solve, Distinguish between blockchain for business and other blockchain implementations, Enumerate the broad categories of blockchain solutions, Understand the state of the blockchain industry in 2019, in terms of technologies, topics and communities, See how today's blockchain implementations vary, Look at the indicators that point to blockchain's future

UNIT-III	**Linux Foundation Hyperledger and Blockchain Use-Cases** Understand the background behind the Linux Foundation Hyperledger project, Enumerate and compare the different Hyperledger projects, Introduce Hyperledger Fabric, Learn about some successful blockchain projects, Evaluate good vs. bad blockchain ideas, Assess business value
UNIT-IV	**Blockchain Developer part 1:-** Block chain principles and its use in the enterprise, Blockchain infrastructure and applications, Identify participants, assets, transactions in a business network, Hyperledger Fabric, Blockchain solution architecture, Peers, smart contracts, channels, world state
UNIT-V	**Blockchain Developer part 2:-** Consensus, ordering service and transaction endorsement, Chaincode structure, lifecycle and deployment approaches., Blockchain deployment with Docker and Kubernetes, Blockchain security on Hyperledger Fabric

TEXT/REFERENCE BOOKS

IBM Courseware

Further suggested Readings

- Implementing Blockchain solutions using Hyperledger

LIVE PROJECT-III & INDUSTRIAL TRAINING	
Course Code: 23CS4115A	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

To provide hands-on experience at site where Computer Science and engineering projects are executed.

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

3. Gather a first-hand experience on sites.
4. Apply the concepts learnt to design and create a application.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2
CO1	✓	✓

LIVE PROJECT-III

Students have to undergo six weeks practical training at the end of sixth semester in Computer Science and Engineering related project sites or with the faculty members of parent or any other institute of repute. At the end of the training they have to submit a report together with a certificate in the format prescribed and make a power point presentation which shall be evaluated.

MINOR PROJECT	
Course Code: 23CS4117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 8	
Credits: 4	

COURSE OBJECTIVE

To simulate real life situations related to Computer Science and engineering and impact adequate training so that confidence to face and tackle any problem in the field is developed.

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.
2. Design and implement automated solutions for the assigned/identified real world problems.
3. Write technical reports.
4. Practice and develop skills in time management and reporting within an industrial or research laboratory setting.
5. Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

MAPPING BETWEEN COURSE OBJECTIVES (CO) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓	✓	✓	✓	✓

PROJECT

Each student is given an exercise which will cover all the aspects (to the extent possible) like investigation, planning, designing, detailing and estimating of a Computer Science and engineering structure in which the aspects like analysis, application of relevant codes, etc., will find a place. Alternately, a few research problems also may be identified for investigation and the use of laboratory facilities to the fullest extent may be taken as a project work. Alternately, a student is encouraged to take an industrial project with any Computer Science and engineering organization or firm. A project report is to be submitted on the topic which will be evaluated.

SEMESTER – VIII

MAJOR PROJECT	
Course Code: 23CS4114	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 24	
Credits: 12	

COURSE OBJECTIVE

The objective of the project semester is to make the students solve real world problems using automated solutions, while developing management and writing skills amongst them.

COURSE LEARNING OUTCOMES:

1. Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.
2. Design and implement automated solutions for the assigned/identified real world problems.
3. Write technical reports.
4. Practice and develop skills in time management and reporting within an industrial or research laboratory setting.
5. Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

MAPPING BETWEEN COURSE OBJECTIVE (CO) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓	✓	✓	✓	✓

MAJOR PROJECT

Each student is given an exercise which will cover all the aspects (to the extent possible) like investigation, planning, designing, detailing and estimating of a Computer Science and engineering structure in which the aspects like analysis, application of relevant codes, etc., will find a place. Alternately, a few research problems also may be identified for investigation and the use of laboratory facilities to the fullest extent may be taken as a project work. Alternately, a student is encouraged to take an industrial project with any Computer Science and engineering organization or firm. A project report is to be submitted on the topic which will be evaluated.

SYLLABUS OF PROFESSIONAL ELECTIVE COURSES

DISTRIBUTED OPERATING SYSTEM	
Course Code: 23CSPE3020	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To know about basic concepts of Distributed operating system.
2. To provide hardware and software issues in modern distributed systems.
3. To get knowledge in distributed architecture and accessibility of resources in distributed file systems.
4. To learn how to store data in Distributed File System and Distributed Share memory.
5. To understand naming, synchronization, consistency and replication, fault tolerance, security in DFS.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Gain knowledge of distributed operating system architecture. 2. Implement distributed client server applications using remote method invocation. 3. Have knowledge of Synchronization and Deadlock. 4. Have sufficient knowledge about file access. 5. Understand Shared Memory Technique, security, and distributed file systems.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	

CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INTRODUCTION TO DISTRIBUTED SYSTEM** Definition, Characteristics of Distributed system, Design issues, Resource sharing and the Web Challenges, System models - Architectural and fundamental models -Networking and internetworking Communication in distributed system: Layered protocols, ATM networks, Client –Server model, Remote Procedure Calls and Group Communication.
UNIT-II	**CONCURRENCY CONTROL** Clock synchronization, Mutual Exclusion, Election algorithm, the Bully algorithm, a Ring algorithm, Transactions - Nested transactions - Locks - Optimistic concurrency control - Timestamp ordering - Comparison - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions
UNIT-III	**DEADLOCK** Deadlock in Distributed Systems, Distributed Deadlock Prevention, Distributed Deadlock Detection, Threads, System models, Processors Allocation, Scheduling in Distributed System, Real Time Distributed Systems.
UNIT-IV	**DISTRIBUTED FILE SYSTEM** Distributed file systems: Distributed file system Design, Distributed file system Implementation, Trends in Distributed file systems. Distributed Shared Memory: What is shared memory, Consistency models, Page based distributed shared memory, shared variables distributed shared memory. Replication in DFS
UNIT-V	**SECURITY** Overview of security techniques, Cryptographic algorithms ,Digital signatures , Cryptography pragmatics, Replication , System model and group communications, Fault tolerant services, Highly available services , Transactions with replicated data

TEXT BOOKS
• Andrew S. Tanenbaum, Maartenvan Steen, Distibuted Systems, ―Principles and Pardigms, Pearson Education, 2002.
• George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, 3rd Edition, Pearson Education, 2002.
REFERENCE BOOKS
• Tanenbaum and Steen, Distributed Systems PHI, 2002.

- Sape Mullender, Distributed Systems 2nd Edition.
- Albert Fleishman, Distributed Systems: Software Design and Implementation, Springer Verlag, 1994.

SOFTWARE PROJECT MANAGEMENT	
Course Code: 23CSPE**3024**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES

1. To provide an in-depth understanding of various concepts of Software project phases.
2. To understood the basics of the project management techniques.
3. To learn the feasible solution and optimum solution for the resource management. Learnt the time estimation and critical path for project.
4. To learn the various quality models and risk management in the resource planning.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Gain knowledge and understanding of basic concepts related to software project phases, estimation and scheduling.
2. Apply basic concepts related to software project planning, scope and feasibility.
3. Analyse of various project management activities such as tracking, project procurement, configuration management, monitoring.
4. Acquire knowledge about quality assurance, quality control, and risk management.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4
CO1	✓	✓		
CO2		✓	✓	
CO3			✓	
CO4				✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS

UNIT-I	**Introduction and Software Project Planning:** Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.
UNIT-II	**Project Organization and Scheduling Project Elements:** Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts. (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.
UNIT-III	**Project Monitoring and Control:** Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.
UNIT-IV	**Software Quality Assurance and Testing Objectives:** Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.
UNIT-V	**Project Management and Project Management Tools Software Configuration Management:** Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

TEXT BOOKS

- Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill, 2004.

REFERENCE BOOKS

- M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
- Royce, Software Project Management, Pearson Education
- Kieron Conway, Software Project Management, Dreamtech Press

- S. A. Kelkar, Software Project Management, PHI Publication

GRID COMPUTING	
Course Code: 23CSPE3026	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To understand how Grid computing helps in solving large scale scientific problems. 2. To gain knowledge on the concept of virtualization that is fundamental to cloud computing. 3. To learn how to program the grid environment. 4. To understand the security issues in the grid environment.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the genesis & know the applications of grid computing. 2. Understand the technology and tool kits for facilitating grid computing. 3. Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids. 4. Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research. 5. Implement a grid computing environment; develop communications skills and accept the code of professional conduct and security practice through short presentations and group work.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓	✓		
CO3				✓	
CO4					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION AND OVERVIEW OF GRID COMPUTING** Early Grid Activities, Current Grid Activities, An Overview of Grid Business Areas, Grid Applications, Grid Infrastructure
UNIT-II	**WEB SERVICES AND RELATED TECHNOLOGIES** Oriented Architecture, Web Service Architecture, XML, Related Technologies and Their Relevance to Web services, XML Messages and Enveloping, Service Message Web Service Interoperability and the Role of the WS-I Organization

UNIT-III	**OGSA** Introduction to Open Grid Services Architecture (OGSA), Commercial Data Center- National Fusion Collaboratory, OGSA Platform Components
UNIT-IV	**OGSI** Introduction-Grid Services, A High-Level Introduction to OGSI, Introduction to Service Data Concepts, Grid Service: Naming and Change Management Recommendations.
UNIT-V	**SECURITY** Trust models for Grid security environment, Authentication and Authorization methods, Grid security infrastructure, and Identity and access management architecture.

TEXT BOOKS

- Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005.
- Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann.
- Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009.

REFERENCE BOOKS

- Barry Wilkinson, "Grid Computing: Techniques and Applications", Chapman and Hall, CRC, Taylor and Francis Group, 2010.
- Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005.

OBJECT ORIENTED ANALYSIS & DESIGN	
Course Code: 23CSPE3028	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To introduce the concepts of OOP and behavioural modelling.
2. To understand the architectural design methods.
3. To learn the application, methodology in a software design.
4. To understand and learn design patterns.
5. To familiarize with the knowledge of design testing in DPIM.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Demonstrate knowledge of structural and behavioral modeling techniques.
2. Demonstrate knowledge of a model-based software development methodology.
3. Create application of the methodology and the modeling techniques in a significant software design project.
4. Demonstrate knowledge of design patterns and their application in a software design project.
5. Demonstrate knowledge of Design and Testing Process Improvement Models.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Introduction to OOP concepts, OO model, analysis, design and implementation.

UNIT NUMBER	COURSE CONTENTS
	Types of models: Unified Modeling Language(UML) views and basic features, Object-oriented design methodologies, the rational unified process, Object-oriented CASE tools. Introduction to six-level improvement process of design process improvement model (DPIM).
UNIT-II	**STRUCTURAL & BEHAVIOURAL MODELLING** Structural Modeling Techniques Basic Building Blocks -- objects and classes, Structural Composition Techniques, Design Scaling Issues, **Behavioural Modelling :** Use Case Diagrams, Interaction Diagrams, Event State Diagrams, Action Matrices, Business Lifecycle Diagrams, Activity Diagrams, Collaboration Diagrams, Rule Specification Techniques, Behavioral Model-Based Reference Architecture for Component Specification.
UNIT-III	**ARCHITECTURAL MODELLING** Deployment: Common Modelling technique; Modelling processors and devices, modelling distribution of artifacts. Collaboration: Modeling roles, modelling the realization of a Use Case, modelling the realization of an operation, modelling a mechanism
UNIT-IV	**Design Standards Architectural Patterns**: Design Patterns, Program Patterns, Behavioral Design Units Component-Based Specification Techniques **DPIM - Level One** : Requirements Analysis Techniques, Ad Hoc Approach to Design **DPIM - Levels Two, Three and Four**: Design Methodology, Deployment Design Quality Control Properties and Analysis Techniques, Automatic Convertability, Traceability, Standardizability (Design Units/Reusable Patterns), Modularity Changeability (Change Management) ,Scalability of Design Reliability
UNIT-V	**DPIM - Levels Five and Six** : Design Process Management and Optimization Design Metric Models Testing Maturity Model Extended V-Model Testing Techniques **OO Testing:** Introduction, Object Oriented testing process, testing of analysis and design model, testing of classes.

TEXT BOOKS
• S. R Schach, Introduction to Object Oriented analysis and Design, Mc Graw Hill, 2003
• Ali Bahrami , "Object Oriented System Development", McGraw Hill International Edition, 1999.
• Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services
REFERENCE BOOKS
• Booch G., "Object Oriented Analysis and Design", Addison Wesley Publishing Company, 2nd Edition, 2000.
• Rambaugh.J, Blaha. M. Premerlani.W, Eddy F and Loresen W, "Object Oriented Modeling andDesign",Prentice Hall of India, 1997.
• Coad P, Yourdon E., "Object oriented analysis", Yourdon Press, 1991.
• Bennett, S., "Schuam's Outline of UML". New York: McGraw-Hill 2004

- S. Perdita. “Using UML: Software Engineering with Objects and Components.” Addison-Wesley 2000
- R. Miles, “Learning UML 2.0”, O’REILLY 2006
- E. Gamma., “Design Patterns: Elements of Reusable Object-Oriented Software”, Addison-Wesley

NEURAL NETWORKS & FUZZY LOGIC	
Course Code: 23CSPE**3030**	Continuous Evaluation: 40 Marks
Pre-Requisite : Soft Computing Course	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To provide in depth detail for perceptron.
2. To get familiar with the principles of RBF, RNN, unsupervised learning.
3. To learn fuzzy set theory, fuzzy logic and understand the role of uncertainty in real-time applications.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the mathematics behind the design of perceptron.
2. Correlate the need of extension of MLP to CNN.
3. Design and analyse the importance of kernel functions, RNN and memories.
4. Differentiate between fuzzy sets and crisp sets.
5. Apply and analyse the applications of fuzzy to reasoning and clustering

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	✓	✓			
CO2			✓		
CO3				✓	✓

COURSE CONTENTS

UNIT NUMBER	**COURSE CONTENTS**
UNIT-I	**INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS (ANN) & SINGLE LAYER PERCEPTRON (SLP)** ANN, Modelling of Human Brain and ANN, Types of ANN, activation function, learning tasks and rules. SLP : Basics of Perceptron, McCulloch Pitt NN, Perceptron Convergence Theorem in both Discrete and Continuous Domain, Linearity and Non-Linearity Problem.

UNIT-II	**MULTI- LAYER FEED FORWARD NETWORKS** Basics of MLP, Generalized Delta Rule, Training Algorithm for MLP, Batch learning, Online Learning, Cross-validation in Back Propagation, Detail Study on Convolution Neural Networks. Basics and need of RBF, Interpolation Problem, RBF networks,
UNIT-III	**RECURRENT NETWORKS & ASSOCIATIVE MEMORIES** Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, Architecture of Hopfield Network: Discrete and Continuous Neural network applications, Boltzman Machine, R-CNN, LSTM, Unsupervised Learning of clusters.
UNIT-IV	**FUZZY SETS, RELATIONS & LOGIC** Classical & Fuzzy Set Theory, Fuzzy Relation, Fuzzy Inference System, Fuzzy Logic and approximate reasoning. Fuzzy control System Design Problem, Industrial Applications.
UNIT-V	**FUZZY ARITHMETIC & OPTIMIZATION** Functions of fuzzy sets, extension principle, fuzzy mapping, interval analysis, vertex method and DSW algorithm. One dimensional fuzzy optimization, fuzzy concept variables and casual relations, fuzzy cognitive maps, agent based models.

TEXT BOOKS
• J.M. Zurada, "Introduction to artificial neural systems", Jaico Pub.
• Simon Haykin, "Neural Networks", PHI
• S. N. Sivanandam and S.N. Deepa, "*Principles of Soft Computing*," 2nd Ed., Wiley India.

REFERENCE BOOKS
• Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004
• Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003
• S. Rajasekharan and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
• Timothy J. Ross, " Fuzzy Logic With Engineering Applications", Tata McGraw-Hill Inc. 2000

CYBER SECURITY	
Course Code: 23CSPE3032	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To aware the students about the cyber security and its implications.
2. To provide students with a practical and theoretical knowledge of cryptography and network security.
3. To provide the students' knowledge of different types of attacks on the Network.
4. To aware the student about data privacy.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
2. Underline the need of digital forensic and role of digital evidences.
3. Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.
4. Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.
5. Apply the knowledge of IDS to secure network and performing router and network analysis.

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓	✓			
CO2		✓	✓		
CO3			✓	✓	
CO4				✓	✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Cyber-attacks, types of attacks, Introduction to cyber security, objectives of security, elements of cyber security, Introduction to Information Security, Introduction to Data and Network Security, Finding vulnerabilities and exploits.

UNIT-II	**INTRUSION DETECTION SYSTEMS** Overview of intrusions, system intrusion process, dangers of system intrusions, anomaly detection, misuse detection, types of IDS, the limitations and open problems of intrusion detection systems, Statistical and machine approaches to detection of attacks on computers, Techniques for studying the Internet attacks, network based attacks, host based attacks.
UNIT-III	**SECURITY IN CLOUD COMPUTING** What is Cloud Computing, Essential Characteristics, Cloud security challenges, Software as a service security, secure software development life cycle, data usage, data privacy, identity access management, physical security.
UNIT-IV	**DATA PRIVACY** Fundamental Concepts, Definitions, Data Privacy Attacks, Data linking and profiling, access control models, role based access control, privacy in different domains- medical, financial, etc.
UNIT-V	**CRYPTOGRAPHY** Services, mechanisms and attacks, the OSI security architecture, Network security Model, classical Encryption techniques, Private and Public Key Cryptography.

TEXT BOOKS

1. Michael T. Goodrich and Roberto Tamassia, "Introduction to Computer Security", Addison Wesley, 2011.
2. B. Raghunathan, "The Complete Book of Data Anonymization: From Planning to Implementation", Auerbach Pub, 2013.
3. John W. Rittinghouse, "Cloud Computing: Implementation Management & Security", CRC Press.
4. Roberto Di Pietro, Luigi V. Mancini, "Intrusion Detection System", Springer ,2008
5. William Stallings-"Cryptography and Network Security", Pearson education, 6th edition, SBN 10**:** 0133354695, 2013

REFRENCE BOOKS

1. Russell Dean Vines and Ronald L. Krutz ,"Cloud Security: A Comprehensive Guide To Secure Cloud Computing", Wiley India Pvt Ltd, 2010.
2. Anderson, James P., "Computer Security Threat Monitoring and Surveillance," Washing, PA, James P. Anderson Co., 1980.
3. L. Sweeney, "Computational Disclosure Control: A Primer on Data Privacy Protection", MIT Computer Science, 2002.

DESIGN THINKING	
Course Code: 23CSPE3034	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To provide an overview of an exciting field of design thinking and business processes.
2. To introduce the tools required for design thinking like IBM Blueworks live, IBM Mural
3. To immerse students into the world of innovation as a systematic process of tackling relevant business and/or social problems.
4. To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions.
5. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Understand and critically apply the concepts and methods of business processes.
2. Understand and apply IBM Blueworks live and process designer tool concepts.
3. Understand and analyzing design thinking history and its various concepts.
4. Understand, analyzing and create models with users collaboration to apply design thinking concepts.
5. Build the process model that is used to implement process application and use different mural template to apply design thinking concepts for solving real world problem.

COURSE LEARNING OUTCOMES (CLO) - COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**INTRODUCTION TO BUSINESS PROCESS MANAGEMENT &AS-IS BUSINESS PROCESS** Define business process management (BPM), List and describe the phases in the BPM lifecycle procedure, Define process modeling., Describe how to use IBM Business Process Manager to accomplish process modeling goals, Explain how to create and modify process applications in the Process Center, Create a process application, Explain case management, Describe the purpose and function of Blue works Live, List and describe the core notation elements that are used in IBM Process Designer, Create a business process definition (BPD) from the process and nested process tasks and responsible, Explain how to create and modify process models with the Designer view of the IBM Process Designer.
UNIT-II	**PLAYBACK 0: MODELING PROCESS** List and describe gateways as they are used in IBM Process Designer, List and describe intermediate event types that are used in IBM Process Designer, Model a business process escalation path with an attached timer intermediate event, Describe the Playback 0 validation goals and requirements, Validate that a process model meets Playback 0 goals and Requirements, Describe IBM Business Process Manager product components, Identify the integrations with other IBM products.
UNIT-III	**ENTERPRISE DESIGN THINKING – HISTORY, OVERVIEW** Understand what came before Design Thinking, Identify who did what to bring it about, Learn how it built upon previous approaches, Get an overview of the whole approach to design thinking, Understand the principles, loop, and keys, Determine what is most important.
UNIT-IV	**ENTERPRISE DESIGN THINKING –7 KEY HABITS, THE LOOP, USER RESEARCH** Learn 7 key habits of effective thinkers design, Avoid common anti-patterns, Optimize for success with these habits, Understand the importance of iteration, Learn how to observe, reflect, & make, Get ready to drill down & do tomorrow, Understand the importance of user research, Appreciate empathy through listening, Learn key methods of user research.
UNIT-V	**ENTERPRISE DESIGN THINKING – MAKE, USER FEEDBACK:-** Understand how Make fits into the Loop ,Learn how to leverage Observe information, Learn Ideation, Storyboarding, & Prototyping, Understand user feedback and the Loop, Learn the different types of user feedback, Learn how to carry out getting feedback.
UNIT-VI	**PROJECT** Creating Discovery Map, Process Model In Blueworks Live. Adding And Viewing Process Details In Blueworks Live Enterprise Design Thinking - User Research, Reflect, Ideation, Storyboarding, Crafting Hills, Prototyping In Mural.

TEXT/REFERENCE BOOKS

- IBM SKILLS ACADEMY

BUSINESS INTELLIGENCE	
Course Code: 23CSPE3038	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To provide an overview of an exciting field of business intelligence.
2. To introduce IBM Cognos Analytics and its position within an analytics solution.
3. To teach the fundamental techniques and principles in achieving big business intelligence with scalability and streaming capability.
4. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the vision of Business Intelligence from a global context.
2. Understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.
3. Apply and analyse various prompt types and conditionally render objects in reports .
4. Evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.
5. Build and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	✓

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**BUSINESS INTELLIGENCE**

	Definition with Real Time Examples, How business intelligence can turn data into insight, Use of Business Intelligence- how it can help to combat fraud and understand social sentiments., Future of business intelligence and analytics.
UNIT-II	**IBM COGNOS ANALYTICS FOR COUNSUMERS** Why IBM Cognos Analytics? What is IBM Cognos? List v/s Crosstab, Examine detail filters and summary filters, Introduction to visualization, Traditional visualization v/s RAVE visualization.
UNIT-III	**IBM COGNOS ANALYTICS:AUTHOR REPORT FUNDAMENTALS** Concepts and types of prompts, expressions using functions, reuse object, drill -through reports, analyse multi-lingual reports, Highlight exceptional data
UNIT-IV	**IBM COGNOS ANALYTICS:AUTHOR REPORT ADVANCED** Theory, query models, SQL statements, distribute reports using bursting, Analyze reports by joining queries, dynamic headers and titles that reflect report data, tooltips that clarify report data, send emails using links in a report.
UNIT-V	**IBM COGNOS ANALYTICS:AUTHOR ACTIVE REPORTS** Active Reports, debug active report, Examine Active Report controls, Active Report variables, Create a simple Active Report using Static and Data-driven controls, decks and data decks to display traditional charts creation and analysis of Dashboard.
UNIT-VI	**PROJECT** Analysis for real case studies using dashboard, stories and exploration with IBM Cognos.

TEXT/REFERENCE BOOKS
• IBM Courseware

Further suggested Readings
• IBM Courseware

INTERNET OF THINGS	
Course Code: 23CSPE3040	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To understand and learn about various protocols of IoT, sensors and their types.
2. To develop schemes for the applications of IoT in real time scenarios.
3. To design business Intelligence and Information Security for IoT

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the vision of IoT and communication protocols from a global context.
2. Understand and apply IoT protocols.
3. Apply and analyze sensor networks and their components to IoT domain.
4. Design portable IoT using appropriate boards.
5. Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.
6. Build and create state of the art architecture in IoT.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓	✓				
CO2			✓	✓		
CO3					✓	✓

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**Introduction to IoT:** Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking, Sensing: Sensors and Transducers, Sensor Classes, Sensor Types, Actuation: Actuator Basics, Actuator Types

UNIT NUMBER	CONTENTS
	Basics of IoT Networking: IoT Components, Inter-dependencies, SoA, Wireless Networks, Protocol Classification, MQTT, Secure MQTT, CoAP, XMPP,AMQP (Advanced Message Queuing Protocol).
UNIT-II	**IoT Protocols:** Protocol Standardization for IoT-M2M and WSN Protocols. **Connectivity Technologies:** IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, Zwave, ISA100.11a
UNIT-III	**Sensor Networks:** Basic Concepts, Wireless Sensor Networks, Sensor Nodes, Node Behaviour, Social Sensing, Application Examples, Target Tracking, Wireless Multimedia Sensor Networks, Coverage, Mobile Wireless Sensor Networks and their Applications, UAV (Unmanned Aerial Vehicle) Networks, Machine to Machine Communication, Interoperability in Internet of Things
UNIT-IV	**Introduction to Arduino**: Basic Concepts of Arduino Platform, Examples of Arduino Programming, Integration of Sensors and Actuators with Arduino, **Introduction to Raspberry Pi**, Implementation of IoT with Raspberry, Software Defined Networking, Software Defined IoT Networking
UNIT-V	**Cloud Computing:** Fundamentals, Service Models, Service Management and Security, Case Studies, Open Source Platform, Sensor Cloud, Fog Computing, **Application Domains of IoT :** Smart Cities: Need for Smart Cities, Challenges in Building Smart Cities, Some Technical Issues behind Enabling Smart Cities, Smart Homes: Home Area Networks (HANs), Connected Vehicles, Smart Grid, Industrial IoT, Data Handling and Analytics, Case Study: Agriculture, Healthcare, Activity Monitoring,
UNIT-VI	**PROJECT** Research Activities on IoT with projects and research letters.

TEXT BOOKS
• Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" — CRC Press-2012
• Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
• Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer- 2011.
• Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.
• The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

REFERENCE BOOKS
• Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly

(SPD), 2016, ISBN 7989352133895

- Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

NETWORK SECURITY & CRYPTOGRAPHY	
Course Code: 23CSPE**4019**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES

1. To know the various art of the security exploitation
2. To learn secure programming techniques
3. To understand the mathematics behind cryptography
4. To know the standard algorithms used to provide confidentiality, integrity and authenticity
5. To learn the public key infrastructure that will be used for security practices

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Present the exploitation present in the security.
2. Discuss various types of attacks and their characteristics.
3. Illustrate the basic concept of encryption and decryption for secure data transmission.
4. Analyze various cryptography techniques and its applications.
5. Develop solutions for security problems.

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓	✓			
CO2		✓	✓		
CO3			✓		
CO4				✓	✓
CO5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**FUNDAMENTALS**

UNIT NUMBER	COURSE CONTENTS
	Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.
UNIT-II	**SYMMETRIC KEY CRYPTOGRAPHY** MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid‟s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.
UNIT-III	**PUBLIC KEY CRYPTOGRAPHY** **MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY**: Primes – Primality Testing – Factorization – Euler‟s totient function, Fermat‟s and Euler‟s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.
UNIT-IV	**MESSAGE AUTHENTICATION AND INTEGRITY** Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509
UNIT-V	**SECURITY PRACTICE AND SYSTEM SECURITY** Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

TEXT BOOKS

- Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, Starch Press, 2008.
- William Stallings, “Cryptography and Network Security: Principles and Practices”, Sixth Edition, Pearson Education, 2014.

REFERENCE BOOKS

• "The Shellcoder's Handbook: Discovering and Exploiting Security Holes", 2nd Edition by Chris Anley et al.
• N. Ferguson, B. Schneier, and T. Kohno. "Cryptography Engineering: Design Principles and Practical Applications". Wiley, 2010. • Neil Daswani, Christoph Kern, and Anita Kesavan, "Foundations of Security: What Every Programmer Needs to Know", Frist Edition, Apress, 2007. • SNMP: A Guide to Network Management (MGH). • Telecom Network Management by H.H. Wang (MGH). • Network Management by U. Dlack (MGH).

SOFTWARE TESTING	
Course Code: 23CSPE4033	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES

1. To understand the basics of Software testing
2. To recognize the various types of software testing techniques
3. To analyse the various levels of software testing
4. To explore software automation process
5. To understand Basic software debugging methods.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Demonstrate the fundamentals of software testing using real world examples
2. Identify and apply relevant testing techniques suitable for a real world scenario
3. Investigate the different levels in testing
4. Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.
5. Use practical knowledge to test software and understand the trade-offs between testing techniques
6. Implement Test Automation process and experiment with testing tools.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓					
CO2		✓			✓	
CO3			✓		✓	
CO4						✓
CO5				✓		

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** What is software testing and why it is so hard? Basic Definitions: Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing.
UNIT-II	**TESTING TECHNIQUES**

UNIT NUMBER	COURSE CONTENTS
	White –Box &Black –Box Testing, Boundary Value Analysis, Equivalence Class Testing, Decision table based Testing, Cause-Effect Graph Technique, Cyclomatic Complexity Analysis.
UNIT-III	**REDUCING THE NUMBER OF TEST CASES** Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing, Regression Testing **Testing Activities:** Unit Testing, Levels of Testing, Integration Testing, Debugging, Domain Testing.
UNIT-IV	**SYSTEM TESTING** Verification and Validation Testing, Alpha Testing, Beta Testing, Stress Testing, Load Testing, Volume Testing, Usability testing, Bug, Bug life cycle.
UNIT-V	**TESTING TOOLS** Test Automation: Scope of Automation, Process Model for Automation, Challenges in Automation, Static Testing Tools, Dynamic Testing Tools, Characteristics of Modern Tools.

TEXT BOOKS

- Software Testing: Principles and Practices, Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Education, 2008.
- Software Testing: Principle, Techniques and Tools, M. G. Limaye, Tata McGraw Hill, 2009.
- Effective Methods for Software Testing, William E. Perry, John Wiley and Sons,

REFERENCE BOOKS

- An Integrated Approach to Software Engineering, Pankej Jalote, Narosa Publishing House, New Delhi 1997.
- The Art of Software Testing, Glenford J.Myers, John Wiley & Sons, 1979.
- Software Testing: A Craftman's Approach, P. C. Jorgensen, CRC Press, 1995.
- Software Testing Techniques, Boris Beizer, Dreamtech, 2006.
- Effective Software Testing: 50 Specific Ways to Improve Your Testing, Dustin, Pearson Education, 2002.

WIRELESS ADHOC AND SENSOR NETWORK	
Course Code: 23CSPE4023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To cover major aspects of ad hoc and sensor networking, from design through performance issues to application requirements.
2. To start with the design issues and challenges associated with implementations of ad hoc and sensor network applications. This includes mobility, disconnections, and battery power consumption.
3. To provide a detailed treatment of proactive, reactive, and hybrid routing protocols in mobile wireless networks. It also covers the IEEE 802.11 Wireless LAN and Bluetooth standards and discusses their characteristics and operations.
4. To cover wireless sensor networks (architecture, design, protocols, and applications).
5. To give students hands-on experience in designing a mobile ad hoc network using the NS2 network simulator.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. To specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.
2. Familiarize with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.
3. Enhance the basic knowledge about the principles and characteristics of wireless sensor networks (WSNs).
4. Understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.
5. Understand the congestion control mechanism at transport layer and to acquire skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓	✓		
CO3				✓	
CO4				✓	✓

CO5					✓

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**AD HOC Wireless** Introduction, Mobile Ad Hoc Networks, Technologies for Ad Hoc Network, Issues in Ad hoc wireless Networks IEEE 802.11 Architecture and protocols. Protocol for AD HOC Wireless Networks. Issues and classification of MAC protocol, Dynamic Source Routing (DBR), Adhoc Distance Vector (AoDV) routing, Routing Protocols, Application of Ad Hoc and sensor networks
UNIT-II	**Transport Layer & Security Protocols** Issues in designing transport layer protocols, classification of transport layer solutions, TCP over Ad Hoc Wireless Networks, Network Security requirements and Attacks
UNIT-III	**Wireless Sensor Networks** Basic Sensor Network Architectural Elements, Applications of Sensor Networks, Comparison with Ad Hoc Wireless Networks, Challenges and Hurdles. Architecture of WSNs Hardware components, Operating systems and execution environments, some examples of sensor nodes, Network Architecture, Sensor networks scenarios, Optimization goals and figures of merit Design principles for WSNs.
UNIT-IV	**Communication Protocols** Physical Layer and Transceiver design considerations in WSNs, Fundamentals of (wireless) MAC protocol, Address and name management in wireless sensor networks, Localization and positioning Routing protocols Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless, Routing Strategies in Wireless Sensor Networks
UNIT-V	**Transport & QoS in WSN** Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples
UNIT-VI	**PROJECT** Research Activities and hands-on experience in designing a mobile ad hoc network using the NS2 network simulator

TEXT BOOKS
• C. S. Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall of India , 2007.
• Andreas Willig and John H. Karl, Protocols & Architectures for Wireless Sensor Networks,

Wiley, 2005

REFERENCE BOOKS

- B. Tavli and W. Heinzelman, Mobile Ad Hoc Networks: Energy-Efficient Real-Time Data Communications, Springer , 1st Edition, 2006
- Ramin Hekmat, Ad-hoc Networks: Fundamental Properties and Network Topologies, Springer , 1st Edition, 2006

ADVANCED JAVA PROGRAMMING	
Course Code: 23CSPE**4035**	Continuous Evaluation: 40 Marks
Pre-Requisite : Core Java Programming	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES

1. To develop graphical programs with networking functionality. Using Graphics, Animations and Multithreading for designing Simulation and Game based applications.
2. To design and develop GUI applications using Swing and Event Handling.
3. To design and develop Web applications.
4. To understand designing of distributed applications using Remote Method Invocation (RMI)

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Learn the graphics and animation on the web pages, using Java Applets.
2. Learn and design a full set of Event driven UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings Usage.
3. Learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.
4. Learn and design the server side programming using Servlets and JSP
5. Use the invocation of the remote methods in an application using RMI.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	✓	✓			
CO2			✓		
CO3				✓	
CO4					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION TO ADVANCED JAVA** Java Streaming – Components and events handling – Threading concepts – Networking features – Byte code interpretation – Media Techniques.
UNIT-II	**SWINGS** Introduction to swings, difference between AWT and Swings, java foundation classes, java swings classes.
UNIT-III	**ADVANCED NETWORKING** Client- Sever computing – Sockets – Content and Protocols handlers – Developing distributed applications – RMI – Remote objects – Object serialization
UNIT-IV	**REMOTE METHOD INVOCATION** Remote Method Invocation (RMI): RMI Architecture, Designing RMI application, Executing RMI application.
UNIT-V	**RELATED JAVA TECHNIQUES** 3D graphics – JAR file format and creation – Internationalization. **SERVLETS** Java Servlets: Servlet Interaction & Advanced Servlets, Life cycle of Servlet, Java Servlet Development Kit, Javax.servlet package, Reading Servlet Parameters, Reading Initialization Parameters, The javax.servlet. http Package, Handling HTTP.

TEXT BOOKS

- Jame Jaworski, "*Java Unleashed*", SAMS Techmedia Publications, 1999.
- H.M.Deitel and P.J.Deitel, "Java how to program with an Introduction to Visual J++*"*, Pearson Education, 1998.
- Java: The Complete Reference, Ninth Edition Paperback by Herbert Schildt
- Advanced Java Programming, Uttam Kumar, Oxford Publications.

REFERENCE BOOKS

- Campione, Walrath and Huml, "*The Java Tutorial*", Addison Wesley, 1999.
- Duane A.Bailey, "*Java Structures*", McGraw-Hill Publications, 1999.
- Jeff Frentzen and Sobotka, '*Java Script*", Tata McGraw-Hill, 1999.
- Jamie Jaworski, "*Java Unleashed*", SAMS Techmedia Publication, 1999.
- Jason Blooberg. Jeff Kawski, and Paul Treffers, "*Web Page Scripting Techniques",*Hayden books, 1996.

NASSCOM ASSOCIATE ANALYTICS - II	
Course Code: **CS4037**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
• To provide knowledge of the tools, technologies & programming languages which is used in day to day business analytics cycle.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the tools, technologies & programming languages which is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Data Management & Introduction to Big Data Tools (NOS 2101)** Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/signal/GPS etc. Export all the data onto Cloud ex. AWS/Rackspace etc. Introduction to Big Data tools like Hadoop, Spark, Impala etc., Data ETL process, Identify gaps in the data and follow-up for decision making.
UNIT-II	**Big Data Analytics & Machine Learning Algorithms (NOS 2101)** Run descriptive' s to understand the nature of the available data, collate all the data sources to suffice business requirement, Run descriptive statistics for all the variables and observer the data ranges, Outlier detection and elimination. Hypothesis testing and determining the multiple analytical methodologies, Train Model on 2/3 sample data using various Statistical/Machine learning algorithms, Test model on 1/3 sample for prediction etc.
UNIT-III	**Data Visualization (NOS 2101)**

	Prepare the data for Visualization, Use tools like Tableau, QlickView and D3, Draw insights out of Visualization tool.
UNIT-IV	**Maintain Healthy, Safe & Secure Working Environment (NOS 9003)** Introduction, workplace safety, Report Accidents & Emergencies, Protect health & safety as your work, course conclusion, assessment
UNIT-V	**Provide Data/Information in Standard Formats (NOS 9004)** Introduction, Knowledge Management, Standardized reporting & compliances, Decision Models, course conclusion. Assessment

TEXT/REFERENCE BOOKS
• NASSCOMM

DATA WAREHOUSING & DATA MINING	
Course Code: 23CSPE4025	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES

1. To teach the basic principles, concepts and applications of data warehousing and data mining.
2. To familiarize Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.
3. To introduce the task of data mining as an important phase of knowledge recovery process.
4. To impart knowledge of the fundamental concepts that provide the foundation of data mining.
5. To perform classification and prediction of data.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand the functionality of the various data mining and data warehousing component.
2. Design data warehouse with dimensional modelling and apply OLAP operations.
3. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.
4. Describe complex data types with respect to spatial and web mining.
5. Extract knowledge using data mining techniques.
6. Apply the Data Mining principles and techniques for real time applications.

COURSE LEARNING OUTCOMES (CLO) - COURSE OBJECTIVES (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓					
CO2		✓				
CO3			✓	✓		
CO4					✓	
CO5						✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**DATA WAREHOUSING AND BUSINESS ANALYSIS:** Data warehousing Components, Building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and

UNIT NUMBER	COURSE CONTENTS
	Transformation Tools, Metadata, reporting, Query tools and Applications, Online Analytical Processing (OLAP), OLAP and Multidimensional Data Analysis.
UNIT-II	**DATA MINING:** Data Mining Functionalities, Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation, Architecture Of A Typical Data Mining Systems, Classification Of Data Mining Systems. Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis, Constraint-Based Association Mining.
UNIT-III	**CLASSIFICATION AND PREDICTION:** Issues Regarding Classification and Prediction, Classification by Decision Tree Introduction to Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods, Model Section.
UNIT-IV	**CLUSTER ANALYSIS:** Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.
UNIT-V	**MINING OBJECT, SPATIAL, MULTIMEDIA, TEXT AND WEB DATA:** Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

TEXT BOOKS

- Data Warehousing In the Real World; Sam Anahory & Dennis Murray; 1997, Pearson.
- Data Mining- Concepts & Techniques; Jiawei Han & Micheline Kamber- 2001, Morgan Kaufmann.
- Data Mining Techniques; Arun Pujari; 2001, University Press; Hyderbad.

REFERENCE BOOKS

- Data Mining; Pieter Adriaans & Dolf Zantinge; 1997, Pearson,
- Data Warehousing, Data Miniing and OLTP; Alex Berson, 1997, Mc Graw Hill.
- Data warehousing System; Mallach; 2000, Mc Graw Hill.
- Building the Data Warehouse; W.H. Inman, 1996, John Wiley & Sons.
- Developing the Data Warehouses; W.H Ionhman,C.Klelly, John Wiley & Sons.
- Managing the Data Warehouses; W.H.Inman, C.L.Gassey, John Wiley & Sons.

MOBILE COMPUTING	
Course Code: 23CSPE**4027**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To provide knowledge of concepts, models, condition of the mobile user and architecture of Mobile networks. 2. To learn about various mobile computing Models and to study about various routing protocols that are suitable for mobile networks. 3. To understand the concept of mobile agents and their applications.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Grasp the concepts and features of mobile computing technologies and applications. 2. Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support 3. Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	**CLO2**	**CLO3**
CO1	✓		
CO2		✓	
CO3			✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Overview of Ad Hoc Networks:** Introduction to Mobile Computing – Challenges and Applications of Mobile Computing- Frequencies for radio transmission- Antennas -Multiplexing — Spread spectrum -MAC Protocols: SDMA- TDMA- FDMA- CDMA. Introduction to Cellular Systems — GSM: Architecture, Services & Protocols-GPRS-Radio frequency identification(Rfid)-Wireless Broadband- Introduction to 1G, 2G, 3G and 4G: features and challenges, Applications of 4G.

UNIT-II	Wireless and Mobile Computing Models LAN Protocols: IEEE 802.11/a /g/n & Bluetooth, Data Management Issues. Sensor Networks- Challenges, Architecture, and Applications.
UNIT-III	**Routing in Mobile Networks** Routing Taxonomy, Applications, Challenges in Mobile Environments, Hidden and exposed terminal problems, Routing Protocols- Proactive, Reactive, and Hybrid protocols, Dynamic State Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance – Vector Routing (DSDV), and Cluster Based Routing Protocol (CBRP), and Temporally Ordered Routing algorithm (TORA), Directed-diffusion, Low Energy Adaptive Clustered Hierarchical (LEACH) routing protocol.
UNIT-IV	**Mobile TCP/IP** Distributed location and data management: Mobile IP- Problem with Mobility, Terminology, Operation, Tunneling, Data transfer to the mobile system, Transport Control Protocol (TCP) Over wireless- Indirect TCP (I-TCP), Snoop TCP, Mobile TCP (M-TCP), Data management issues, Data delivery models, Broadcast disks, data replication, Data caching and design issues, Air indexing, Transaction processing in mobile computing environment.
UNIT-V	**MOBILE AGENTS** Introduction to Mobile Agents, Mobile agents vs. Client server, Agent migration and design issues, Mobile agent communication, Mobile Agent Security – Security Requirements and Cryptographic Techniques, Taxonomy of Possible Attacks – Malicious Agents, Malicious Agencies, Protecting Mobile Agents - Preventing Attacks on Mobile Agents, Detecting Attacks on Mobile Agents, Protecting Agencies - Agent Authentication and Authorization.

TEXT BOOKS

- Charles E. Perkins, Ad hoc Networks, Addison Wesley, 2008.
- Mazliza Othman, Principles of mobile computing and communications, Auerbach Publications, 2007.

REFERENCE BOOK

- Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH.
- Wireless Communications & Networks, Second Edition,William Stallings by Pearson
- TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition,TMH

OPEN SOURCE SOFTWARE	
Course Code: 23CSPE**4031**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To introduces concepts, principles and applications of open source software. 2. To discuss about open source software development process. 3. To understand the difference between open source software and commercial software. 4. To familiarize with Linux operating system. 5. To understand and development of web applications using open source web technologies like Apache, MySql and PHP (LAMP/XAMP).

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the difference between open source software and commercial software.
2. Identify, install and run Linux operating system.
3. Install and manage applications.
4. Identify, install open source web technologies Apache, MySql, PHP.
5. Develop web applications using LAMP.
6. Write session control PHP code for a website.

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
CO1	✓	✓				
CO2		✓	✓			
CO3			✓	✓		
CO4				✓	✓	
CO5					✓	✓

COURSE CONTENTS

UNIT NUMBER	**COURSE CONTENTS**
UNIT-I	**UNIT I OPEN SOURCE**: Introduction to Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Where I can use Linux? Linux Kernel – Linux Distributions.

UNIT NUMBER	COURSE CONTENTS
UNIT-II	**UNIT II LINUX**: Introduction to Linux Essential Commands - Filesystem Concept - Standard Files 1. The Linux Security Model - Vi Editor - Partitions creation - Shell Introduction 2. String Processing - Investigating and Managing Processes - Network Clients - Installing Application.
UNIT-III	**UNIT III APACHE**: Apache Explained - Starting, Stopping, and Restarting Apache - Modifying the Default Configuration - Securing Apache - Set User and Group - Consider Allowing Access to Local Documentation - Don't Allow public html Web sites - Apache control with .htaccess.
UNIT-IV	**UNIT IV MYSQL**: Introduction to MYSQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.
UNIT-V	**UNIT V PHP**: Introduction- General Syntactic Characteristics - PHP Scripting - Commenting your code - Primitives, Operations and Expressions - PHP Variables - Operations and Expressions Control Statement - Array - Functions - Basic Form Processing - File and Folder Access - Cookies - Sessions - Database Access with PHP - MySQL - MySQL Functions - Inserting Records - Selecting Records - Deleting Records - Update Records.

TEXT BOOK

- James Lee and Brent Ware, "Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", Dorling Kindersley (India) Pvt. Ltd, 2008.

REFERENCE BOOK

- Eric Rosebrock, Eric Filson,"Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.
- Philosophy of GNU URL: http://www.gnu.org/philosophy/.
-
- Version control system, URL: http://git-scm.com/
- SVN version control, URL: http://svnbook.red-bean.com

NASSCOM ASSOCIATE ANALYTICS - III	
Course Code: 23CSPE**4039**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
• This course provides knowledge of the advanced concepts of tools, technologies & programming languages which is used in day to day business analytics cycle.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the tools, technologies & programming languages which is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**Introduction to Predictive Analytics & Linear Regression (NOS 2101)** What and Why Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of data and variables, Data Modelling Techniques, Missing imputations etc. Need for Business Modelling, Regression – Concepts, Blue property-assumptions-Least Square Estimation, Variable Rationalization, and Model Building etc.
UNIT-II	**Logistic Regression Objective Segmentation (NOS 2101)** Model Theory, Model fit Statistics, Model Conclusion, Analytics applications to various Business Domains etc. Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and complexity, Multiple Decision Trees etc.
UNIT-III	**Time Series Methods/Forecasting, Feature Extraction (NOS 2101)** Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average, Energy etc and Analyze for prediction.
UNIT-IV	**Working with Documents (NOS 0703)** Standard Operating Procedures for documentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of

	documents – case studies, articles, white papers, technical reports, minutes of meeting etc., Style and format, Intectual Property and Copyright, Document preparation tools – Visio, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.
UNIT-V	**Develop Knowledge, Skill and Competences (NOS 9005)** Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping, etc.

TEXT/REFERENCE BOOKS
• NASSCOMM

SYLLABUS OF ABILITY ENHANCEMENT COURSES

COMMUNICATIVE ENGLISH
(COMMON TO ALL BRANCHES OF B.TECH.)

Communicative English (Common To All branches of B.Tech)	
Credits: 2	**Continuous Evaluation**:40 Marks
L T P: 2 0 0	**End Semester Examination**:60 Marks
Prerequisite: Nil	**Course Code:**

COURSE OBJECTIVES (CO)

1. To prepare the students for their career which will require them to listen to, read, speak, and write in English both for their professional as well as interpersonal communication
2. To empower the students to improve both abilities to communicate and their linguistic competence and boost their confidence.
3. To enable the students to properly communicate and express themselves in writing.
4. To enable students to identify the common mistakes made by most learners of English and not make those errors both in their writing and speaking.
5. To study, understand and implement each unit according to National Education Policy 2020 and Bloom's Taxonomy.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Recall and identify English vocabulary words and grammatical structures.
2. Analyse the structure and organization of written texts, identifying the introduction, body, and conclusion.
3. Examine how the use of specific language techniques impacts the effectiveness of communication.
4. Assess and critique public speeches and presentations based on clarity, coherence, and persuasiveness.
5. Evaluate one's own language skills and identify areas for improvement.

MAPPING MATRIX OF COURSE OBJECTIVES (CO) & COURSE LEARNING

COURE

Course Objective	Course Learning Outcomes				
	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓	✓	✓		
CO 2		✓		✓	
CO 3					
CO 4				✓	✓
CO 5					✓
					✓

CONTENTS

Unit-I: Introduction to Communication

• The importance of communication through English at the present time; the process of communication and factors that influence communication: sender, receiver, channel, code, topic, message, context, feedback, 'noise', filters and barriers;

• Verbal and non-verbal communication

• Listening Skills: Importance and types of Listening

• Identifying and rectifying common errors: Subject-verb agreement, Concord, Types of Sentences (Statements, interrogative, exclamatory and imperative, wh- questions, question-tags)

• Use of modals

• Vocabulary Building, word collocation

Unit-II: Workplace Communication

• Communication challenges in culturally diverse workforce; Ethics in Communication
• Bias-free communication
• Effective Business Presentations: Importance in workplace communication; Planning, Preparing, Organizing, Rehearsing, and Delivering Oral presentations, Handling Questions; Power Point Presentation

Unit-III: Writing at Work

• Business letters
• Writing notices, circulars, emails.
• Writing reports and precis writing
• Writing CVs (for Technical Positions and Internships)

Unit-IV: Soft Skills/Life Skills

• Body Language
• Connected Speech (Intonation in Everyday Speaking and Conversation)
• Types of interviews, Planning and preparing for a Job Interview; Stages of an Interview; Mastering the art of giving interviews.

TEXT BOOKS

1. English Grammar in Use. Raymond Murphy. Cambridge UP.4th Edition.
2. Business Communication by Carol M Lehman, Debbie D Dufrene and Mala Sinha. Cengage Learning. 2nd Edition.
3. A Textbook of English Phonetics for Indian Students by T. Balasubramanian [MACMILLAN]
4. Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman and Shalini Upadhyay. Cengage Learning. 2018 Edition.

REFERENCE BOOKS

1. Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.
2. Communication skill by Sanjay Kumar & Puspa Lata, Oxford University Press. 2nd Edition.
3. Business Communication Today by Courtland L Bovee and Thill, Pearson

Communicative English Lab (Common To All branches of B.Tech)	
Credits: 1	**Continuous Evaluation**:60 Marks
L T P: 0 0 2	**End Semester Examination**:40 Marks
Prerequisite: Nil	**Course Code:**

COURSE OBJECTIVES (CO)

1. To prepare the students for their career which will require them to listen to, read, speak, and write in English both for their professional as well as interpersonal communication
2. To empower the students to improve both abilities to communicate and their linguistic competence and boost their confidence.
3. To enable the students to properly communicate and express themselves in writing.
4. To enable students to identify the common mistakes made by most learners of English and not make those errors both in their writing and speaking.
5. To study, understand and implement each unit according to National Education Policy 2020 and Bloom's Taxonomy.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Summarize conversations, demonstrating understanding of the content.
2. Apply communication strategies to maintain conversations and express ideas clearly.
3. Critique and assess various spoken interactions to identify strengths and areas for improvement in communication.
4. Create engaging dialogues or role-plays that demonstrate real-life communicative scenarios.
5. Develop and present persuasive arguments or opinions on various topics in English.

MAPPING MATRIX OF COURSE OBJECTIVES (CO) & COURSE LEARNING

Course Objective	Course Learning outcomes				
	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓	✓	✓		
CO 2		✓		✓	
CO 3			✓	✓	
CO 4				✓	
CO 5					✓

LIST OF Activities

Unit-I

• Listening and Speaking
• Accent in speech
• Longer Discourse (dialogues, songs, contextual speech etc.)
• Role-play
• Practicing sounds of English
• Extempore
• Presentations

Unit-II

• Reading comprehension practice: Technical text
• General text

Unit-III

• Guided composition
• Free-writing

TEXT BOOKS

1. English Grammar in Use. Raymond Murphy. Cambridge UP.4th Edition.
2. Business Communication by Carol M Lehman, Debbie D Dufrene and Mala Sinha. Cengage Learning. 2nd Edition.
3. A Textbook of English Phonetics for Indian Students by T. Balasubramanian [MACMILLAN]
4. Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman and Shalini Upadhyay. Cengage Learning. 2018 Edition.

REFERENCE BOOKS

1. Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.
2. Communication skill by Sanjay Kumar & Puspa Lata, Oxford University Press. 2nd Edition.
3. Business Communication Today by Courtland L Bovee and Thill, Pearson

GERMAN LANGUAGE PHASE I	
Course Code: 21FLGR301	Continuous Evaluation: 40.Marks
Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

- To develop oral and written skills of understanding, expressing and exchanging Information/ interacting.
- To develops the ability to construct sentences and frame questions.
- To provide German language as a competitive edge in career choices.
- To know the culture of the countries where the German language is spoken.
- To provide employment opportunities as well as helping them to develop projects on browsing German websites

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

- Read and write short, simple texts.
- Have Fluency in reading and writing.
- Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
- Know the culture of the countries where the German language is spoken.
- Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : INTRODUCTION

Grüße, Wortschatz

UNIT-II : THEMEN

Das Alphabet, die Aussprache, die Zahlen, Land und Stadt beschreibung, Berufe, rede über Dinge, die Zeit, Mahlzeiten und Getränke

UNIT-III : GRAMMATIK

Plural, Artikel, Possessive Artikel, Adjektive, Sich vorstellen, Verben (regulär, unregelmäßig, Pronomen), Nominativ Pronomen, Präpositionen,

UNIT-IV : WORTSCHATZ

emanden vorstellen, Nationalitäten, Länder, Zahlen, Über die Wochentage sprechen, Die Monate des Jahres, Die Berufe, Die Farben, Die Gegensätze, Die Sätze mit der Zeit

UNIT-V : MÜNDLICHER AUSDRUCK

Mündliche und Höraktivitäten

TEXT BOOK

1. Tangram aktuell 1 (Lektion 1-4 Kursbuch + Arbeitsbuch, Lektion 5-8 Kursbuch + Arbeitsbuch, Übungsheft)

REFERENCE BOOKS

2. Wolfgang Hieber: Lernziel Deutsch, Teil 1. Max Hueber Verlag

3. Korbinian Braun, u.a.: Deutsch als Fremdsprache IA, Grundkurs. Ernst Klett Stuttgart

4. Rolf Brüseke: Starten Wir! A1. München: Hueber Verlag

GERMAN LANGUAGE PHASE II	
Course Code: 21FLGR401	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

- To demonstrate their ability to recognize, identify, extract and/or differentiate key information conveyed in spoken announcements, instructions, and in interactions between native speakers on familiar topics.
- To demonstrate effective speaking and listening skills in German on informal and some formal topics related to personal, professional, academic, and leisure activities.
- To develop awareness of the nature of language and language learning.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

- Read and write short, simple texts.
- Have Fluency in reading and writing.
- Use language creatively and spontaneously.
- Get awareness about cross-cultural and intercultural difference.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓		
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : THEMEN

Einkaufen, Tagesablauf, Lebenslauf , Nach dem Weg fragen, Wegbeschreibungen, Der Körper, Ereignisse der Vergangenheit erzählen

UNIT-II : GRAMMATIK

Trennbare und untrennbare Verben, Dativ , Modalverben, Präteritum von sein, haben, Perfekt

UNIT-III : WORTSCHATZ

Kleidung, Haushaltswaren, Sachen zum Essen und Trinken, Verkehrsmittel, Namen von Orten und Sehenswürdigkeiten, Information über Deutschland, Ordinalzahlen

UNIT-IV : KOMPOSITION

Themen zum schreiben wie Deutschland und Delhi, was haben Sie am wochenende gemacht, Traummann/Traumfrau

UNIT-V: Mündlicher Ausdruck

Sprechen uber die Stadt, Das Haus, Meine Famile

TEXT BOOK

1. Tangram aktuell 1 (Lektion 1-4 Kursbuch + Arbeitsbuch, Lektion 5-8 Kursbuch + Arbeitsbuch, Übungsheft)

REFERENCE BOOKS

2. Wolfgang Hieber: Lernziel Deutsch, Teil 1. Max Hueber Verlag

3. Korbinian Braun, u.a.: Deutsch als Fremdsprache IA, Grundkurs. Ernst Klett Stuttgart

4. Rolf Brüseke: Starten Wir! A1. München: Hueber Verlag

Website pages:

1. https://www.nthuleen.com/teach.html

FRENCH LANGUAGE PHASE I	
Course Code: 21FLFR301	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

- To develop oral and written skills of understanding, expressing and exchanging Information/ interacting.
- To develops the ability to construct sentences and frame questions.
- To provide French language as a competitive edge in career choices.
- To know the culture of the countries where the French language is spoken.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

- Read and write short, simple texts.
- Have Fluency in reading and writing.
- Use language creatively and spontaneously.
- Know the culture of the countries where the French language is spoken.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : INTRODUCTION

Les Salutations, Vocabulaire

UNIT-II : SUJETS

L'Alphabet, Le Prounciation, Les Nombres, Décrire votre pays, ville, Les Professions, Parler de choses,L'Heure, Les Repas et les boissons

UNIT-III : GRAMMAIRE

Le Nom et le pluriel des noms, Les Articles, Les Adjectifs Possessifs, Les Adjectifs Qualificatifs, Se présenter, Les Verbes (Regular, irregular, pronominaux), Les Pronoms Sujet, Les Prépositions, L'interrogation

UNIT-IV : LEXIQUE

Présenter quelq'un, Les nationalités, Les Pays, Les Nombres, Parler des jours de la semaine, Les mois de l'année, Les Professions, Les Couleurs, Les Contraires, Les phrase avec l'heure

UNIT-V : L'EXPRESSION D'ORALE

Les activites d'orale et ecouter

TEXT BOOK

1. Version Originale – 1 Livre de l'élève: Monique Denyer, Agustin Garmendia, Marie-Laure Lions Olivieri, Editions Maisons des Langues, Paris

REFERENCE BOOKS

2. Nathan verbs conjugasion , Le Robert Nathan, Paperback

3. Larrouse French to English Dictionary, Larrouse, Paperback

4. Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, Cle International, Paris.

FRENCH LANGUAGE PHASE II	
Course Code: 21FLFR401	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

- To Demonstrate an elementary knowledge of French sentence structure through speaking and writing.
- To develop the language proficiency required to communicate effectively in French.
- To form a sound base of the skills, language and attitudes required for progression to work or further study, either in French or another subject area.
- To develop awareness of the nature of language and language learning.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

- Read and write short, simple texts.
- Have Fluency in reading and writing.
- Use language creatively and spontaneously.
- Know the culture of the countries where the French language is spoken.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓		
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : SUJETS

La France, Le Fromage, le vin, Les saisons, Les recettes, Indiquer un chemin,Demander la direction, Donner des indications, Le corps, Les elements du passé, Raconteur une journée

UNIT-II : GRAMMAIRE

La negation, L'imperatif ,Le passé recent,Le future, Le passé compose, L'imparfait, Les nombres ordinaux

UNIT-III : LEXIQUE

Les vêtements, Les animaux, Parler de prix, Le corps, Vocabulaire de la gare et du train, Le voyage, Les achats Les Prepositions, L'interrogation

UNIT-IV : Composition
les sujets pour l'ecriture comme la maison, l'ecole

UNIT-V : L'expression d'orale
Les etudiants ecrivent le petit paragraphess sur les sujets en utillisant les expression et le temps comme ma maison , ma famille.

TEXT BOOK

1. Version Originale – 1 Livre de l'élève: Monique Denyer, Agustin Garmendia, Marie-Laure Lions Olivieri, Editions Maisons des Langues, Paris

REFERENCE BOOKS

2. Nathan verbs conjugasion , Le Robert Nathan, Paperback
3. Larrouse French to English Dictionary, Larrouse, Paperback
4. Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, Cle International, Paris.
5. Alter Ego Part 1
6. Echo Part 1

SYLLABUS OF SKILL ENHANCMENT COURSES
SEMESTER – III

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 3**	**Course Category**	**SEC**
Course Code	**23SS351**	**Course Title**	**Effective Communication Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To define and understand communication and its process.
- TO2. To make student practice on communication skills via LSRW approach via instructing, engaging, assessing and re engaging.
- TO3. To enhance the confidence and motivation of a student by honing his communication skills.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To communicate effectively and interact with people with confidence.
- TLO2. To demonstrate and differentiate between various forms of communication.
- TLO3. To apply effective communication skills confidently which a student need to get ahead in job and life.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) TRAINING OBJECTIVES (TO)	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

Unit	Course Contents	Student Engagement Activity
Unit-I	**Verbal Communication Skills** • Communication Process & its importance • 7 C's of Communication • Formal & Informal Conversation • Requirements of effective verbal communication	Conversation Cards Activity
Unit-II	**Nonverbal Communication Skills** • Importance of nonverbal skills in effective communication • Types of nonverbal (body language) skills	Power of Body Language Activity

	• Barriers to nonverbal communication	
Unit-III	**Listening Skills** • Role of listening skills in effective communication • Barriers to listening • Overcoming listening barriers • Empathetic listening & avoiding selective listening	Chinese Whisper Activity
Unit-IV	**Reading & Writing Skills** • Types of reading strategies to enhance improve reading skills • Types of written communication	The What IF Activity
Unit- V	**Visual Communication** • Types of visual communication • Importance of visual communication • Picture narration/description technique	Interpret The Picture Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press, 2019.

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Effective Communication Skills Course

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Verbal Communication Skills	Speech Activity	15	Written Test	10
II	Non Verbal Communication Skills	Role Play	15		
III	Listening Skills	Oral Assessment / Written Assessment	10		
IV	Reading & Writing Skills		20	Viva	20

V	Visual Communication		10		

SEMESTER –IV

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 4**	**Course Category**	**SEC**
Course Code	**23SS452**	**Course Title**	**Teamwork & Interpersonal Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To make the students learn & demonstrate effective teamwork, leadership & interpersonal skills.
- TO2. To equip the students with capability of handling stress and utilization of work time effectively.
- TO3. To make the students understand the importance and application of Emotional Quotient, Critical Thinking & Problem Solving Skills.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To be confident working in a team and leading it as well.
- TLO2. To categorize the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energies himself to bounce back from such situations.
- TLO3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- TLO4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)

Training Learning Outcomes (TLO) / Training Objectives(TO)	TLO1	TLO2	TLO3	TLO4
TO1				
TO2				
TO3				

Unit	Course Contents	Student Engagement Activity

Unit - I	**Team Management** • Team communication & team conflict resolution • Role of a team leader • Team goal setting & understanding team development • Team dynamics & multicultural team activity • Johari Window Model	Collaborative Working Game Activity
Unit-II	**Time Management** • Time management matrix • Pareto Principle (80/20 rule) • Development process of plan of action	What You Did Yesterday Activity
Unit-III	**Leadership** • Difference between leadership & management • Types of leadership style • Core leadership skills	Lead The Blindfolded Activity
Unit-IV	**Stress Management** • Sign of stress & its impact • Types of stress • Techniques of handling stress	Keeping Cool Activity
Unit - V	**Emotional Intelligence** • Emotional intelligence & emotional competence • Components & behavioral skills of emotional intelligence	Guess The Emotion Game Activity
Unit - VI	**Critical Thinking** • Types of thinking & Characteristics • Critical thinking standards • Barriers to critical thinking	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Teamwork & Interpersonal Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Team Management	Role Play / Group Activity	10	Written Test	10
II	Time Management		10		
III	Leadership		10		
IV	Stress Management	Assignment	10	Viva	20
V	Emotional Intelligence	Written Test	10		
VI	Critical Thinking		20		

SEMESTER – V

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 5**	**Course Category**	**SEC**
Course Code	**23SS553**	**Course Title**	**Presentation Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO):-

- TO1. To develop the public speaking skills in the student.
- TO2. To make the students learn and adapt to the necessary etiquettes required working and growing in corporate culture.
- TO3. To make the students learn to speak in a debate session by putting his arguments and making others accept his viewpoint convincingly.

Training Learning Outcomes (TLO): -
After the completion of the training, the student will have ability:

- TLO1. To be confident in presenting himself in front of audience.
- TLO2. To become professional in his approach towards work culture.
- TLO3. To enhance the level communication skills while interacting with others.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
Training Learning Outcomes (TLO) **Training Objectives(TO)**	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

Unit	Course Contents	Student Engagement Activity
Unit-I	**Importance of Presentation Skills** • 4 P's of presentation skills – plan, prepare, practice & present • Guidelines for effective presentation	PPT Presentation Activity
Unit-II	**Storytelling Skills** • 4 P's of storytelling skills – people, place, plot & purpose • Types of storytelling techniques • Importance of storytelling skills	Start From Where I Stopped Activity

Unit-III	**Corporate Culture Etiquettes** • Importance of professional behavior at work place • Understand & implementation of etiquettes at work place • Importance of values & ethics • Types of professional / corporate etiquettes	Etiquettes Role Play Activity
Unit-IV	**Debate / Extempore** • Difference between debate, extempore & group discussion • Learning argument /counter argument in debate	Current Affair Topic Speech Activity
Unit-V	**Art of Creating Impression** • Importance of creating first impression • 6 ways to master the art of creating impression	Speech Activity
Unit-VI	**Problem Solving** • Types of problems & its solutions Problem solving process & tools	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Presentation Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Importance of Presentation Skills	Presentation Activity	20	Written Test	10
II	Storytelling Skills	Speech Activity	15		
III	Corporate Culture Etiquettes	Assignment	10		
IV	Debate/Extempore	Speech Activity / Written Activity	15	Viva	20
V	Art of Creating Impression		10		
VI	Problem Solving				

SEMESTER – VI

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 6**	**Course Category**	**SEC**
Course Code	**23SS654**	**Course Title**	**Professional Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To encourage students to learn and apply the effective writing skills.
- TO2. To make the students learn various types of business correspondence letters, cover letters & resume.
- TO3. To encourage students to learn as to how to talk and convince people in GD & interview.
- TO4. To make the students learn to build rapport for building positive relationships professionally at workplace.

Training Learning Outcomes (TLO): -
After the completion of the training, the student will have ability:

- TLO1. To understand the importance of professional writing required in workplace.
- TLO2. To explore different formats in resume, cover letters & other business related letters.
- TLO3. To develop knowledge, skills and understanding people in-group and individually.
- TLO4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)

Training Learning Outcomes (TLO) Training Objectives(TO)	TLO1	TLO2	TLO3	TLO4
TO1				
TO2				
TO3				
TO4.				

Unit	**Course Contents**	**Student Engagement Activity**

Unit-I	**Email Writing** • Importance of email communication skills • Basic rules of effective email writing • Structure of email – address, subject, message text, attachments, signature	Email Practice Activity
Unit-II	**Resume Writing** • Difference between Resume, CV & Bio data • Guidelines of resume writing • Resume preparation of the student	Resume Making Activity
Unit-III	**Letter Writing** • Types of Letter Writing – Application, Leave, etc. • Cover letter	Letter Writing Activity
Unit--IV	**Group Discussion (GD)** • Characteristics of GD & subject knowledge • Do's & Don'ts in GD • Strategies of GD • Types of GD	Group Discussion Practice Activity
Unit-V	**Interview Skills** • Preparation of the interview & company details information • Do's & Don'ts in interview • Types of Interviews • Strategies of interview	Mock Interview Practice Activity
Unit-VI	**Negotiation Skills** • Importance of negotiation skills • Four phases of negotiation skills • Barriers to negotiation & overcoming it • Win-win negotiation	Win-Win Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Professional Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Email Writing	Written Assignment	10	Written Test	10
II	Resume Writing		10		
III	Letter Writing		10		
IV	Group Discussion	Group Discussion Activity	15	Viva	20
V	Interview Skills	Mock Interview Activity	15		
VI	Negotiation Skills	Role Play	10		

SEMESTER – VII

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**4 / 7**	**Course Category**	**SEC**
Course Code	**23AR755**	**Course Title**	**Aptitude & Reasoning**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To understand the basic concepts of quantitative ability and logical reasoning.
- TO2. To make student practice on the concepts of quantitative ability and logical reasoning.
- TO3. To prepare the students for aptitude and reasoning round in placement selection process & other competitive exams.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To understand the basic concepts of quantitative ability.
- TLO2. To solve campus placements aptitude papers covering Quantitative Ability.
- TLO3. To Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) TRAINING OBJECTIVES (TO)	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

A-Quantitative Ability

UNIT - I

- Number System
- Percentage
- Profit, Loss and Discount
- Simple Interest and Compound Interest

UNIT – II

- Allegation and Mixture
- Average
- Ratio, Proportion and Variation, Problem on Ages and Numbers
- Time and Work
- Time, Speed and Distance

UNIT – III

- Permutation and Combination
- Probability
- Data Interpretation
- Geometry and Menstruations
- Sequence, Series & Progression and Logarithmic

B- Logical Reasoning

UNIT - IV

- Number Series and Alphabet Series
- Direction Sense Test
- Coding -Decoding
- Blood Relation

UNIT – V

- Syllogism
- Dice, Cube and Cuboids
- Seating Arrangement

UNIT – VI

- Clock and Calendar
- Critical Reasoning
- Order and Ranking, Ven diagram, Analogy

Learning Resources	
Text Books	***Quantitative Aptitude for Competitive Examinations*** by R S Aggarwal: S Chand Publishing, 2022.
	A Modern Approach to Logical Reasoning by R S Aggarwal: S Chand Publishing, 2022.

Pedagogy-

- The training will be based on the concept of learning by doing and practice.
- The training will involve 50% of the training time on teaching the concepts and the remaining 50% will be focusing on practice.
- The training will follow a circular approach where students are taught, evaluated and given the feedback.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Aptitude & Reasoning

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Quantitative Ability	Written Assignment	10	Written Test	30
II			10		
III			10		
IV	Logical Reasoning		15		
V			15		
VI			10		

SYLLABUS OF MULTIDISCIPLINARY COURSES

Department of Mathematics			
Multi-Disciplinary Course (MDC)			
Year/Semester	**1st Year/1st Semester**	**Course Category**	**Multidisciplinary Course**
Course Code		**Course Title**	**Statistical Methods**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Basic Mathematics		**L T P : 2 0 2**	**Credits: 3**

Course Objectives (CO) - The Course is designed with the following objectives:

1. To introduce the basics of statistics and graphical representation of data
2. To equip the students with measures of central tendency and dispersion
3. To learn about correlation and regression analysis
4. To know about the probability in daily life

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. Understand the basics of statistics and explain data for graphical representation
2. Understand the concept of measures of central tendency and measures of dispersion
3. Understand the basics of correlation and regression
4. Understand the concept of probability in real life scenario

Mapping Matrix between Course Objectives and Course Learning Outcomes:

CLO / CO	CL 1	CL 2	CL 3	CL 4
CO 1	✓			
CO 2		✓		
CO 3			✓	
CO4				✓

COURSE CONTENTS:

Unit-I: Introduction to Statistics

Importance of statistics, concepts of statistical population and a sample, data collection methods, primary and secondary data, primary and secondary data. Designing a questionnaire, types of data– quantitative and qualitative data. Measurement scales –Nominal, Ordinal, Interval and Ratio. Classification and tabulation of data, Diagrammatic and Graphical representation of data.

Unit -II: Univariate Data Analysis

Measures of Central Tendency- mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Skewness and Kurtosis.

Unit-III: Bivariate Data Analysis

Bivariate Data, Scatter plot, Correlation, Karl Pearson's correlation coefficient, Rank correlation – Spearman's and Kendall's measures. Concept of errors, Principle of least squares, fitting of polynomial and exponential curves. Simple linear regression and its properties. Fitting of linear regression line and coefficient of determination

Unit -IV: Probability

Department of Environmental Sciences			
Program: UG program			
Year/Semester	1[s] Year/I or II	**Course Category**	**MDC**
Course Code		**Course Title**	Environmental Geoscience & Disaster Management
Continuous Evaluation: 40		**End Semester Examination:** 60	
Prerequisite: Nil		**L T P** : 3 0 0	**Credits: 3**

Probability: Introduction, random experiments, sample space, events, and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem, and its applications.

Practical/Lab Work to be performed in Computer Lab

The practical will be taught using Excel software and/or using some statistical software like R /SPSS. Students are encouraged to use resources available on open sources.

- Graphical representation of data.
- Practical based on measures of central tendency.
- Practical based on measures of dispersion.
- Practical based on combined mean and variance and coefficient of variation.
- Practical based on moments, skewness, and kurtosis.
- Fitting of polynomials, exponential curves.
- Karl Pearson correlation coefficient.
- Correlation coefficient for a bivariate frequency distribution.
- Lines of regression, angle between lines and estimated values of variables.
- Problems based on conditional probability and Baye's theorem

Reference Books

1. Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley
2. Goon A.M., Gupta M.K. and Dasgupta B. Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002
3. Fundamental of Mathematical Statistics by S.C. Gupta and V.K Kapoor, Saurabh Jain 2017
4. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition R for beginners by Emmanuel Paradis (Freely available) at https://cran.rproject.org/doc/contrib/Paradisrdebuts_en.pdf)

COURSE OBJECTIVES (COs): The Course is designed with the following objectives:

1. To provide fundamental knowledge of earth origin and earth Processes.
2. Educate the students about the types of rocks & geological resources.
3. To understand the Disaster and Disaster management.
4. Role of Geospatial technology in geological resources and Disaster management.

COURSE LEARNING OUTCOMES (CLOs)

The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. Able to explain the origin and Internal structure of earth.
2. Analyse the Geological resources and geochemistry of minerals.
3. Collect a comprehensive understanding of disaster management.

4. Evaluate the role of technology in disaster management.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	COURSE LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	**CLO1**	**CLO2**	**CLO3**	**CLO4**
CO1	√			
CO2		√		
CO3			√	
CO4				√

COURSE CONTENTS

Unit-1

Origin of the Earth:

Theories and hypothesis of the origin of earth- Oparin-Haldane hypothesis, Big bang theory, the material basis of life, geological time scale, evolution of earth's atmosphere and life through the geological time scale.

Unit-2

Internal Structure of the Earth:

Internal Structure of Earth, differentiation of the earth into core, mantle, crust. Formation of core, mantle, crust, atmosphere, hydrosphere, and biosphere. Convection in Earth's core and production of its magnetic field. Geothermal gradient and internal heat of the Earth. Earthquake and earthquake belts: seismic waves and internal constitution of the Earth. Volcanoes and volcanism, distribution of volcanoes.

Unit-3

Fundamentals of Earth process

Concepts Rocks, Formation of rocks, types of rock (Igneous rock, Metamorphic Rocks, and Sedimentary rocks), Continental drift theory, Plate tectonic, sea floor spreading. Basic concepts of weathering, erosion, and deposition of earth materials by water wind and glaciers.

Unit-4

Geological Resources and Exploration:

Fundamentals of geological resources, their formation, reserves in minerals, coal, oil, gas geological constraints in their availability and use; environmental consequences of their exploitation to air, water, soil, climate, and life. Distribution of minerals in India.

Unit-5

Disaster Management:

Disaster introduction- disaster management, capability vulnerability, risk, preparedness and mitigation. Disaster management cycle. Hazard zonation and mapping- risk reduction measures. Landslide, Earthquake, Tsunami, Flood, Minamata Disaster, Bhopal Gas Disaster, 1984, Chernobyl Disaster, 1986, Fukushima Daiichi nuclear disaster, 2011. Role of geo-spatial technology in surveillance, monitoring, risk assessment, and disaster management Sendai Framework for Disaster Risk Reduction.

RECOMMENDED TEXTBOOKS:

1. Mukherjee, S. (2004). Text Book of Environmental remote Sensing. Published by Macmillan India Limited New Delhi ISBN: 1403922357.
2. Keller, E.A. (1996). Introduction to Environmental Geology. Prentice Hall, Upper Saddle River, New Jersey.
3. Disaster management by R. Subramanian, Vikash Publishing house, ISBN 9352718704

REFERENCE BOOKS

1. Keller, E.A. (1996). Introduction to Environmental Geology. Prentice Hall, Upper Saddle River, New Jersey.
2. J.R Jensen, Remote Sensing of the Environment: An Earth Resource Perspective, 2012

Principals of Management & Organizational Behaviour	
Course Code: 23MDC 401	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
Prerequisite: NIL	Course Category: Multidisciplinary

COURSE OBJECTIVES

1. To understand the functions and responsibilities of managers.
2. To acquaint the students with the fundamentals of managing business.
3. To understand individual and group behaviour at work place so as to improve the effectiveness of an organization.
4. To analyse human behaviour in the organization setting in order to manage it in accordance to the intentions.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate the roles, skills and functions of management.
2. Analyse the causes and consequences of applying different business strategies.
3. Analyse and compare individual behaviour related to motivation and rewards.
4. Identify group behaviour, leadership styles and the role of leaders in a decision making process.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

Course Objectives (COs)	**Course Learning Outcomes (CLOs)**			
	CLO 1	**CLO 2**	**CLO 3**	**CLO 4**
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit 1: Introduction to the management

Management Concept, Nature, Process and significance, levels of management, managerial skills, functions of management, management and administration, evolution of management, Role of management and insights from Indian practices and ethos.

Unit 2: Functions of the management

Planning: Types of Plans & The planning process; Organizing: Common organisational structures; Staffing: features and necessity; Leading: types of leaders; Controlling: functions and types

Unit 3: Introduction to Organizational Behaviour

Meaning, importance and scope of OB; abilities: meaning and forms, attitudes: framework, work related attitudes, personality: types, assessment, perception: process, factors influencing perception, perceptual errors

Unit 4: Foundation of Group Behaviour

Defining and classifying groups; need to join groups, stages of group development; group dynamics: group properties as roles, norms and size; group decision making techniques, conflict management

TEXT BOOKS

1. Stephen Robbins, Organizational Behavior, 16th edition (2012), Pearson Education.
2. K. Aswathappa, Organizational Behaviour, 13th edition (2016), Himalaya Publishing House.
3. Fred Luthans, Organizational Behavior, 14th edition (2017), McGraw-Hill.

SUGGESTED READINGS

1. Gregory Moorhead & Ricky W. Griffin, Organizational Behaviour, 11th edition (2009), Jaico Publication.
2. Tripathy PC and Reddy PN, Principles of Management, 6th edition (2011), McGraw-Hill.

Year/Semester	3rd / 4th	Course Category	MDC
Course Code	23MDC501	Course Title	Library Information Science & Media Literacy
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

Course Objectives (CO) - The Course is designed with the following objectives:

CO-1:To know the library collection and their classifications.
CO-2: To discuss the library information services.
CO-3: To understand the importance of media
CO-4: To grasp the significance of motive of media

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020.
Upon completion of this course, learners will be able to:

CLO-1: Explain the library collection and their classifications.
CLO-2: Analyse the library information services.
CLO-3: Analyse the media roles.
CLO-4: Analyse the motive of media.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

	CO-1	CO-2	CO-3	CO-4
CLO-1	√			
CLO-2		√		
CLO-3			√	
CLO-4				√

COURSE CONTENTS:

UNIT-1: Library Collection

- Type of Information Sources : Primary, Secondary and Tertiary
- Reference Collection: Type of reference sources
- Indexing and Abstracting Journals
- Multimedia Collection
- Arrangement of Information Sources : Classification

UNIT-2: Information Services

- Bibliography: Type of Bibliography
- Reviews Literature
- Citation Style
- Citation Analysis: Web of Science and Scopus
- Online Databases : Structure and Retrieval

UNIT-3: Media Literacy

- Introduction to Media Literacy
- Type of media: Traditional versus social media
- Bias in media

UNIT-4: Motive of Media

- Media tycoons and conditions in which media works

- Research and Publication ethics

Recommended Books:

1. Richard E. Rubin & Rachel G. Rubin ,Foundations of Library and Information Science, 5th Edition. ISBN-9781783304776, Facet Publication, UK
2. https://en.unesco.org/themes/media-and-information-literacy/resources

Year/Semester	3rd /5th	Course Category	Multidisciplinary Course (MDC)
Course Code	23MDC502	Course Title	IPR for Business
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES:

The objective of this Multidisciplinary Course (MDC) is to familiarize the students with various types of IPR and its relevance to the businesses and their respective streams.

CO 1: To provide students with a basic understanding of various types of IPR and its relevance for business.
CO 2: To acquaint students with the strategies and management techniques associated with intellectual property assets, and the legal considerations and challenges involved.
CO 3: To familiarize the students with the challenges and legal considerations related to intellectual property disputes.
CO 4 To develop skills related to management of intellectual property in business.

COURSE LEARNING OUTCOMES

At the end of this course, the students would be able to:
CLO1: Define and discuss about the various types of IPR and its relevance for business

CLO2: Discuss the adjudicating bodies and mechanisms under each of these IPRs

CLO3: Analyze and resolve business disputes relating to IPR

CLO4: Apply the learning to the real-life situations in business

MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	COURSE LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	CLO1	CLO2	CLO3	CLO4
CO1	√			
CO2		√		
CO3			√	
CO4				√

COURSE CONTENT

UNIT 1
INTRODUCTION TO INTELLECTUAL PROPERTY AND BUSINESS

- Concept of IPR in business and its types
- International Context - Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO), World Trade Organization (WTO) and the UNESCO
- Innovation as a Business Strategy and relevance of protecting the ideas legally
- National IPR Policy

UNIT 2
COPYRIGHT

- Concept of Copyright and importance for businesses
- Media business – protecting performer's rights
- Performers' and Broadcasters' Rights Law
- Assignment, Transmission, Licensing of Copyrights
- Infringement of Copyrights and remedies

UNIT 3
TRADEMARKS

- Trademark – value of and relevance for businesses
- Protecting brand value- acquiring trademark nationally and internationally
- Trade mark disputes – case studies

UNIT 4
PATENTS

- Protecting innovation – acquiring patents nationally and internationally
- Product and process patents
- Assigning patents and its commercialization
- Patent Disputes

UNIT 5
INDUSTRIAL PROPERTIES

- Industrial designs – protection - Procedure for Registration of Designs • Copyright under Design
- Semiconductor Integrated Circuits Layout-Designs
- Plant varieties – commercialization - Monsanto cases
- Geographical Indications
- Biotechnology and IPR

UNIT 6
REGISTRATION AND ENFORCEMENT MECHANISMS

- Registration authorities of various IPRs
- IP Management and assertion of rights through declarations – use of copyright, trademark signs
- IP Litigation – Approach of courts – landmark cases

TEXT BOOKS:

- WIPO DL-101 General Course on Intellectual Property (online)
- Elizabeth Verkey and Jithin Saji Issac, *Intellectual Property,* Eastern Book Company 2021
- Anurag K. Agarwal, *Business and Intellectual Property: Protect your Ideas*, IIM Ahmedabad. Random House India (2016)
- *Handbook on IP Commercialisation - Strategies for Managing IPRs and Maximising Value* Jakarta: ASEAN Secretariat, November 2019

REFERENCES BOOKS:

- ICSI Study Material, Intellectual Property Rights: Law and Practice, A. Ramaiya, Guide to the Companies Act, LexisNexis, 19th Ed. 2020 (in 6 volumes)
- WIPO, *Enterprising Ideas A Guide to Intellectual Property for Startups*, 2023
- Manuals published by Office of the Controller General of Patents, Designs & Trade (CGPDTM), available at https://ipindia.gov.in/
- Guide Books by WIPO –Intellectual Property for Business, available at https://www.wipo.int/publications/en/series/index.jsp?id=181

Year/Semester	3rd / 6th	Course Category	Multidisciplinary Course
Course Code	23MDC602	Course Title	Indian Economy
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES

1. To introduce about different demography terms and trends.
2. To make students familiar with growth and its distribution.
3. To discuss the major changes in agriculture sector over-time.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. review major demographic indicators
2. comprehend the concept of inequality
3. analyse agriculture sector

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)		
	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

COURE CONTENTS

Unit-I

Population and Human Development

Demographic trends and issues; education; health and malnutrition. Demographic features of India's population.

Unit-II

Growth and Distribution

Trends and policies in poverty; inequality and unemployment.

Unit-III

Agriculture

Importance of Agriculture; Causes of backwardness and low productivity; Land Reforms: Need, Implementation and Critical Evaluation

TEXT BOOKS

1. Jean Dreze and Amartya Sen, 2013. *An Uncertain Glory: Indiaand its Contradictions*, Princeton UniversityPress.
2. Pulapre Balakrishnan, 2007, The Recovery of India: Economic Growth in the Nehru Era, *Economic and Political Weekly*,November.
3. Rakesh Mohan, 2008,―Growth Record ofIndian Economy: 1950-2008.AStory of Sustained Savings and Investment, *Economic and Political Weekly*,May.
4. S.L. Shetty, 2007,―India's SavingsPerformancesincethe Advent ofPlanning,in K.L. Krishna and A. Vaidyanathan, editors, *Institutions and Markets in India's Development.*
5. Himanshu, 2010,―TowardsNew Poverty LinesforIndia, *Economicand Political*

Weekly,January.

Year/Semester	3rd / 6th	Course Category	MDC
Course Code	23MDC604	Course Title	Electoral Literacy in India
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

Course Objectives (CO) - The Course is designed with the following objectives:

1. To know the meaning and nature of the electoral democracy in India
2. To discuss electoral institutions in India
3. To understand the procedural aspect of elections in India
4. To grasp the significance of elections and electoral aspects of democracy, the electoral model code of conduct, issues, and challenges in India's democracy.

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. The student shall be able to understand the meaning, definition, and significance of elections in India.
2. The course will help the students to analyse and understand electoral institutions, and their role and functions in the conduct of free and fair elections.
3. The student shall be able to know the party system of India.
4. The course will help the student understand issues and challenges in conducting free and fair elections in India.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

Course Learning Objectives (Cos)	Course Learning Outcome (CLOs)				
	CLO1	CLO2	CLO3	CLO4	CLO5
CO1					
CO2					
CO3					
CO4					

COURSE CONTENTS:

UNIT-1: Elections in India

- Suffrage, Types, and Methods of Elections
- Parliamentary elections: Lok Sabha & Rajya Sabha
- Presidential Elections
- State Legislative Assembly Elections
- Local Body Elections

UNIT-2: Electoral Institutions

- Election Commission (EC)
- State Election Commission
- Constitution: Part-15

UNIT-3: Political Parties in India

- One-party, Two Party, Multi-party system
- Model Code of Conduct, Party Funding, and Campaign

UNIT-4: Elections: Issues and Challenges

RECOMMENDED TEXTBOOKS:

1. Subhash C. Kashyap, Our Political System, 2nd, National Book Trust, India, 2008, ISBN: 8123752520
2. D. D. Basu, Introduction to The Constitution Of India, 26th Edition, Lexis Nexis, ISBN: 978-9388548861

3. Bidyut Chakrabarty, Rajendra Kumar Pandey, Indian Government and Politics, Sage Text, ISBN: 8132100581

REFERENCE BOOKS:

1. Sanjay Kumar, Elections in India: An Overview, 1st, Routledge, ISBN: 9781032033136
2. https://eci.gov.in/
3. https://www.lokniti.org/
4. Websites of State Election Commission
5. NCERT, Chapter-3 Indian Constitution at Work

Creating Entrepreneurial Mind Set	
Course Code:	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3-0-0	**Course Type:** MDC

COURSE OBJECTIVES

1. To disseminate knowledge about basics of entrepreneurship and forms of ownership.
2. To enlighten students regarding the relevance of creativity and innovation from an entrepreneurship point of view.
3. To give clarity to students regarding formulation of business plan.
4. To familiarize students with the upcoming trends in the entrepreneurship field.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand basics of entrepreneurship and different types of ownerships.
2. Grasp relevance of creativity and innovation and its application in a business.
3. Acknowledge components of a business plan and ways to launch it.
4. Utilize conceptual building skills in interpreting trends for the entrepreneurs.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

Course Objectives (COs)	**Course Learning Outcomes (CLOs)**			
	CLO 1	**CLO 2**	**CLO 3**	**CLO 4**
CO 1				
CO 2				
CO 3				
CO4				

COURSE CONTENTS

UNIT	CONTENTS
UNIT-I	**Basics of Entrepreneurship** Entrepreneur: Definition, characteristics, functions, types of an entrepreneur; Concept of Entrepreneurship, types, role of entrepreneurship in economic development, Factors affecting Entrepreneurship.
UNIT-II	**Entrepreneurial Development Programme** Entrepreneurial Development Programme (EDP): meaning & concept; The Role and Relevance of Entrepreneurial Development Program in India; Role of Government in Organizing EDP's Critical Evaluation; Women Entrepreneurship- Meaning, Reasons for Slow Growth, Problems faced by Women Entrepreneurs, Development of women Entrepreneurship.
UNIT-III	**Business Planning** Opportunity Identification and selection, Formulation of business plan, External Environmental Analysis - Economic, Social, financial, technological, competitive, and legal. Financing: Sources, venture capital, export finance.
UNIT-IV	**Entrepreneurial Trends in the Digital Age** Definition and significance of digital entrepreneurship; Brief overview of key digital trends impacting businesses; Disruptive Technologies; Promoting innovation and adaptability in a digital ecosystem

TEXT BOOKS

1. Burns, Entrepreneurship and small business, 4th edition (2016), Palgrave.
2. Norman M. Scarborough, Essentials of entrepreneurship and small business management, 9th edition (2018), Pearson.
3. Hisrich, R., & Peters, M., Entrepreneurship, 11th edition (2020), Tata McGraw Hill.
4. Prahalad, C. K. (2006). Fortune at the bottom of the pyramid, eradicating poverty through profits. Wharton school Publishing.
5. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries

SUGGESTED READINGS

1. Khandwalla, P., Corporate creativity, 7th edition (2017), Tata Mc. Graw Hill.
2. Mullins, J., New business road test, 4th edition (2013), Prentice Hall.
3. Drucker, P. F. (2006). Innovation and entrepreneurship: Practice and principles. USA: Elsevier.
4. Gersick, K. E., Davis, J. A., Hampton, M. M., & Lansberg, I. (1997). Generation to generation: Life cycles of the family business. Boston: Harvard Business School Press.
5. Holt, D. H. (2004). Entrepreneurship new venture creation. New Delhi: Prentice Hall of India.

Year/Semester	3rd / 5th	Course Category	MDC
Course Code	23MDC503	Course Title	Psychology and Emotional Intelligence
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES (COs):

CO1:To know the concepts in sociology relevant to the study of society.

CO2:To discuss classical sociological thoughts by sociologists.

CO3: To understand modern and post modern sociological thoughts.

CO4: To grasp the significance of sociological theories in understanding society

CO5: To construct the relation between individual and social structure in the society.

COURSE LEARNING OUTCOMES (CLOs):

After the successful completion of the course, the students will have the ability to:

CLO1: Explain various sociological concepts important in the understanding of society.

CLO2: Application of critical conceptual understanding that is central to sociological investigations.

CLO3: Analyzing the social phenomena with respect to theoretical understanding of society.

CLO4: Recommend analytical as well as methodological understanding to generate authentic knowledge.

CLO5: Integrate the knowledge of social issues in society according to advanced, contemporary, interdisciplinary knowledge.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

CLO CO	CLO 1	CLO 2	CLO 3	CLO 4	CLO
CO 1	✓				
CO 2		✓			
CO 3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

UNIT–I: INTRODUCTION

- Definition, Scope, Nature and Importance of Sociology
- **SOME BASIC CONCEPTS:** Status & Role, Power & Authority, Social Structure & Function

UNIT-II : SOCIETY AND SOCIAL BEHAVIOUR

- **SOCIETY AND SOCIAL BEHAVIOUR**: Society: Meaning & Characteristics, Culture, Socialization: Definition & Agencies, Social Mobility: Meaning & Types, Social Group: Meaning and Types

UNIT-III : SOCIAL CONTROLS & SOCIAL BEHAVIOUR

- **MEANING AND NATURE OF SOCIAL CONTROL**: Social Controls & Social Behaviour : Types: Folkways, Mores, Norms, Values, Law
- **SOCIAL CONFORMITY AND DEVIANCE :** Meaning of Conformity & Deviance

UNIT-IV: THEORETICAL PERSPECTIVES

- **MACRO PERSPECTIVE:** Theoretical perspectives: Functionalism, Conflict, Structuralism
- **MICRO PERSPECTIVE:** Theoretical perspectives: Symbolic Interactionism, Exchange Theory, Labelling Theory

UNIT-V: CLASSICAL THEORISTS

- **EMILE DURKHEIM:** Division of Labour in Society, Suicide
- **KARL MARX**: Historical Materialism, Class and Class Conflict, Alienation
- **MAX WEBER**: Authority, Social Action, Ideal Types

UNIT-VI : THEORIES OF MODERNITY

- Juggernaut of Modernity, McDonaldization, Risk Society
- **GLOBALIZATION AND INEQUALITY**: Global justice, Need for Global governance

TEXT BOOKS

1. Anthony Giddens, Sociology, Polity Press (2019)
2. Harlambos, M. Sociology: Themes and Perspectives, Oxford University Press
3. C.N. Shankar Rao, **Sociology: Principles Of Sociology With An Introduction To Social Thoughts**, S. Chand Publications, (2019)

REFERENCE BOOKS

1. Transformation: Theory and Society in India, Oxford University Press (2010)
2. Andre Beteille. Six Essays in Comparative Sociology, Oxford University Press
3. M. Francis, Abraham. Contemporary Sociology: An Introduction to Concepts and Theories, Oxford University Press (2014)

PERSONAL FINANCIAL PLANNING	
Course Code:	**Continuous Evaluation**: 40
Credits: 03	**End Semester Examination**: 60
L T P : 3-0-0	**Course Type**: MDC
Prerequisite: Student should be aware about various saving schemes and their future benefits.	

4. J.P.S. Uberoi. Mind and Society: From Indian Studies to General Sociology, Edited by Khalid Tyabji, Oxford University Press (2019)

COURSE OBJECTIVES

1. Build an understanding to familiarize different aspect of personal financial planning.
2. Analyze and compare different sources of savings and investment.
3. Develop a perspective to understand necessary knowledge and skills for effective Tax planning.
4. Develop skills to assess need for the insurance and retirement planning.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Analyze the meaning and appreciate the relevance of financial planning
2. Analyze the Integration of various avenues of investment for future benefit.
3. Examine the scope and ways of personal tax planning.
4. Analyze the insurance and retirement planning with relevance.

MAPPING MATRIX COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

CLO / CO	01	02	03	04
01				
02				
03				
04				

UNIT	Course contents
UNIT-I	**Introduction to Financial Planning** Financial goals, steps in financial planning, budgeting incomes and payments, time value of money. Introduction to savings, benefits of savings, management of spending & financial discipline, Setting alerts and maintaining sufficient funds for fixed commitments.
UNIT- II	**Investment Planning** Process and objectives of investment, concept and measurement of return & risk for various asset classes, measurement of portfolio risk and return, diversification & portfolio formation, Various Investment avenues
UNIT- III	**Personal Tax Planning** Tax structure in India for personal taxation, Scope of personal tax planning, exemptions and deductions available to individuals under different heads of income and gross total income.
UNIT- IV	**Insurance and Retirement Benefits Planning** Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance, Pension plans available in India

BOOKS

1. Halan, M. ―Let‘s Talk Money: You've Worked Hard for It, Now Make It Work for You‖ Harper Collins Publishers, 2020 New York.
2. Madura, J. ―Personal Finance, 2021,Pearson Publication
3. Indian Institute of Banking & Finance. ―Introduction to Financial Planning, Taxmann Publication, 2021, New Delhi.
4. Keown A.J. ―Personal Finance, Pearson Publication, 2021, New York.

REFERENCE BOOKS

1. Pandit, A. ‐The Only Financial Planning Book that You Will Ever Need, Network 18 Publications Ltd., Mumbai.
2. Sinha, M. ‐Financial Planning: A Ready Reckoner, McGraw Hill Education, New York.
3. Tripathi, V. ‐Fundamentals of Investment, Taxmann Publication, New Delhi.

SYLLABUS OF VALUE ADDED COURSES

Year/Semester	2nd Year/ 3rd Semester	**Course Category**	**VAC**
Course Code	23 VAC 301	**Course Title**	Sports , Yoga & Fitness
Continuous Evaluation : 80		**End Semester Examination : 20**	
Prerequisite: Nil		**L T P :1 0 2**	**Credits: 2**

Course Objectives (CO) - The Course is designed with the following objectives:

1. To know about the physical body
2. To discuss about improve range of motion, mobility and coordination in body
3. To understand the ways to improve strength, balance and flexibility.
4. To grasp the significance of yoga and sports in fitness
5. To construct environment for individual and community health.

Course Learning Outcomes (CLO)–The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to :**(BLOOM'S TEXONOMY)**

1. Explain the role of yoga and fitness in life.
2. Apply the rules of healthy and fit life
3. Analyse the ways and methods of yoga and sports
4. Recommend the practices of Asanas and different sports
5. Integrate the concept of yoga and sports in all round development of students and beings.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

UNIT-I: Health and Wellness

- Meaning Definition and Importance of Health and Wellness
- Dimensions of Health and Wellness
- Role of Exercise in maintaining Health and Wellness
- Stress and Its management through Exercise
- Nutrition for Health and Wellness
- Practical-Exercise for Health and Wellness
  - Warming –Up
  - Stretching Exercises
  - Strengthening Exercises
  - Cardiovascular Exercises
  - Flexibility and Agility Exercises

- Limbering Down
- Relaxation Techniques (IRT, QRT, DRT etc.)

UNIT-II Yoga and Fitness

- Importance of Yoga and Fitness
- Types and Principles of Asanas
- Fitness Components
- Specific Exercises for Strength,Flexibility, Speed,Agility & Coordinative Abilities
- Yoga, Fitness and Personality
- General Specific Warm up
- Aerobics / Zumba Dance
- Asanas
- Recreation for Fitness
- Report preparation, Records and PPT

UNIT-III Sports and Psychology

- Definition of Sports Psychology
- Adolescence-Problems related with Adolescence i.e.physical problems, Peer groupRelationship, Career Selection,Drug Abuse, Psychological and Emotion problems
- Importance of Sports Psychology

UNIT-IV Sports and Recreation

- Meaning Definition and Concept of Sports Fitness and Recreation
- Objectives,Characteristics and principles of Sports Fitness and Recreation
- Importance,Purpose, Benefits of Fitness and Recreation
- Types of Recreation
- Recreation through Sports and Games
- Use of Leisure Time Activities and their educational values
- Traditional, Folk and Indigenous Games
- Three Days outdoor camp and Hiking
- Cycling, tie up with District/State Associations
- Visits to Recreational Clubs

RECOMMENDED TEXT BOOKS:

1. Foundations of Physical Education, Chales A. Bucher
2. Foundations of Physical Eduction, M.L.Kamlesh
3. History and Principles in Physical Education, Dr. Karan Singh
4. Essentials of Physical Education, Dr. Ajmer Singh
5. Foundations of Physical Education, Dr. A.K.Uppal
6. Physical Education, Manu Sood, New SP Books
7. Health the basis of life: Dr. John Maclay
8. Natural Health & Yoga, Brij Bhushan
9. Health Education, S.K.Mangal
10. Essential of Physical Education, Dr. Ajmer Singh & Dr. Bains

INDIAN CONSTITUTION & POLITY (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 21HS102/202	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

- To acquaint the students with legacies of constitutional development in India and help them to understand the most diversified legal document of India and philosophy behind it.
- To make students understand the detailed analysis and importance of Fundamental Rights, their relationship with Directive Principles and the significance of Fundamental Duties.
- To acquaint the students with the way social, political and economic justice could be realized.
- To acquaint the students with the basic postulates of constitutional framework regarding the organization, powers and functions of the various organs of the State.
- To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
- To acquaint students with latest intellectual property rights, relating to patent & copyright and innovation environment with related regulatory framework.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks an balances.
- Differentiate different aspects of Indian Legal System and its related bodies
- To appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.
- Know about the enforcement remedies available under the Constitution of India
- To apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy
- To apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

COURSE CONTENTS

Unit-I

- Meaning of the Constitution, Constitutional Law and Constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution
- Indian Constitution and its Salient Features
- The Preamble of the Constitution
- Federal Nature of the Constitution
- Parliamentary System

Unit-II

- Fundamental Rights:
    - Right to Equality (Articles 14 to 18)
    - Right to Freedom (Articles 19 to 22)
    - Right against Exploitation (Articles 23 to 24)

- Right to Freedom of Religion (Articles 25 to 28)
- Cultural and Educational Rights (Articles 29 to 30)

- Directive Principles of State Policy (Article 36-51)
- Fundamental Duties (Article 51 A)

Unit-III

- Powers and Functions of the President and the Prime Minister (Articles 52-62, 74-78)
- Powers of Indian Parliament: Functions of Rajya Sabha, Functions of Lok Sabha
- Centre-State Relations (Article 245-293) (Briefly refer Disaster Management Act 2005)
- Judiciary – Supreme Court: Appointment of Judges, Judicial Review, Writ jurisdiction (Article 32, 124,126) Functions of High Court and Subordinate Courts (Article 217, 224, 226, 233)
- Amendment of the Constitution: Powers and Procedure (Article 368)

Unit-IV

- Regulation to Information- Introduction, Right to Information Act, 2005
- Information Technology Act, 2000
- Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement.

TEXT/REFERENCE BOOKS

1. Brij Kishore Sharma: Introduction to the Indian Constitution, PHI, New Delhi, latest edition.
2. Granville Austin: The Indian Constitution: Cornerstone of a Nation. 1966, Oxford Clarendon Press.
3. Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT,2018.
4. P. M. Bakshi: The Constitution of India, Latest Edition, Universal Law publishing.
5. H.M. Seervai, Constitutional Law of India (4th Ed., Universal Law Publishing Co. Pvt. Ltd. 2008)
6. M.P. Jain, Indian Constitutional Law (6th Ed. Lexisnexis Butter worths Wadhwa, 2010)
7. J.N. Pandey, Constitutional Law of India (Latest Edition)
8. V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)
9. Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, NewDelhi-88
10. P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
11. Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, OrientL ongman.
12. BL Wadehra: Patents, Trademarks, Designs and Geological Indications. Universal Law Publishing - LexisNexis.
13. Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)

Course

Environmental Bioengineering			
Year/Semester	**1ST/I or II**	**Course Category**	
Course Code		**Course Title**	Environmental Bioengineering
Continuous Evaluation: 40		**End Semester Examination: 60**	
Prerequisite: Nil		**L T P : 2 0 0**	**Credits: 2**

Objectives (CO) - The Course is designed with the following objectives:

5. To provide a comprehensive understanding of the relationship between humans and the environment.
6. Aims to introduce students to the different components of the environment.
7. To develop the understanding of pollution, its causes, and their effects
8. To familiarize the students with the different biological concepts.

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020 and based on the UGC curriculum framework. Upon completion of this course, learners will be able to:

5. Analyse the environmental pollution and sensitize themselves to adverse health impacts of pollution.
6. Demonstrate to safeguard the Earth's environment and its resources.
7. Explain sustainable development, its goals, challenges, and global strategies.
8. Improve biological concepts using an engineering approach.

MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	COURSE LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	**CLO1**	**CLO2**	**CLO3**	**CLO4**
CO1	√			
CO2		√		
CO3			√	
CO4				√

COURSE CONTENTS

Unit-1

Human and Environment

Introduction to earth environment, Scope and importance. Components of the environment: Lithosphere, Hydrosphere, Biosphere, Atmosphere. The man- environment interaction, Population growth and natural resource exploitation, Industrial revolution, and its impact on the environment. Understanding of pollutant and pollution; Types of Pollution, Air pollution: Water pollution, Soil pollution and solid waste, Noise pollution, Thermal pollution and their impact on human health

Unit-2

Natural Resources, Sustainable Development & Sustainable living

Overview of natural resources, Classification of natural resources, Resources: Forests, wetlands, Status and challenges. Water resources: Types of water resources, issues and challenges; Soil and mineral resources, Energy resources: renewable and non-renewable sources of energy. Biodiversity and its distribution, Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges, and strategies for SDGs. Ways to live in sustainable manner- Conservation of energy, water at home, plantation, waste segregation, kitchen gardening.

Unit-3

Introduction of Bioengineering:

Significance of biology, fundamental similarities, and differences between science and engineering-humans as the best machines, brain as a computer, comparison between eye camera, **Biomolecules**: molecules of the life –monomeric unit and polymeric structure, carbohydrates, proteins; nucleotides and lipids. bioengineering introduction and current status in Agriculture, Medicine (vaccine and biosensors) enzyme technology, and environment, and the role of artificial intelligence and robotics in human health monitoring.

Unit 4

Bioengineering in Environment Protection:

What is environmental bioengineering? applications of bioengineering in the environment protection. global environmental problems and bioengineering approaches for their management. sewage treatment, biofertilizers, biofuels, bioreactors, bioremediation, and bioengineering for biomedical waste management. role of artificial intelligence in handling biomedical waste.

RECOMMENDED TEXT BOOKS:

1. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science Englewood Cliffs, NJ: Prentice Hall.
2. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
3. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
4. Environmental Studies for Undergraduate Courses by Erach Bharucha, UGC New Delhi
5. Biology: a Gopal approach Campbell, N.A Reece, J.B Urry, Lisa; Cain M.L Wasserman, S.A Minorsky, P. V Jackson, R. B Person Education ltd.

REFERENCE BOOKS:

1. A.K De Environmental Chemistry New age Publisher, 2016.
2. "Ecology & Environment" P D Sharma, Rastogi Publications, 2009.
3. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/.
4. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/ standards.

Principles of Biochemistry (V Edition) by Nelson, D.L; and Cox, M. M. W. H Freeman and company.